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The Contract of Employment

By A. H. Rodrick

Obligations of the employer and of the employee in regard to discharge, promise of extra payment, and working subsequently for a competitor

MANY employers, as evidenced by the litigation in the courts of our various states, do not realize the legal potentialities which may arise from the relationship of employer and employee. When a man or woman appears at an office, factory or store, asks for a job and is put to work, a contract, through the medium of offer and acceptance, immediately exists which becomes just as legally binding as if it were written in the most technical legal phraseology, bound by the customary blue manuscript cover and pink tape, and signed, sealed, witnessed, or sworn to. An employer, unless he has had legal training or has a counsel in his employ, does not know just how far he can go with, or what he can exact from, his employees without eventually finding himself a party to a lawsuit with its attendant worry, loss of time, financial outlay, and publicity. Can I discharge an employee when I feel so disposed? Can I make a promise to an employee and refuse to fulfill it? Can I prevent an employee from working for a competitor after he leaves me? These are a few of the questions employers are asking and about which some know little.

> Can I discharge an employee when I feel so disposed? Can I make a promise to an employee and refuse to fulfill it? Can I prevent an employee from working for a competitor after he leaves me? These are questions employers are asking and about which some know very little

A treatise on the law of contracts would obviously be beyond the scope of this article but a knowledge of its fundamental principles is necessary and can be briefly explained. A contract is an agreement between two or more competent parties, based upon a consideration, to do or not to do a legal thing. Agreement is the expression, either by words or conduct, of a common intention to affect the legal relations of the persons. From the very nature of agreement the first essential is the consent of the parties. There must be a meeting of the minds in one and the same intention. In the absence of this element there can be no agreement, and therefore, without agreement, there can be no contract.

It is manifest that at least two parties are necessary. There may be more than two, but there cannot be less. It is therefore impossible for a man to make an agreement or contract with himself. Competent parties are those who are competent at law to enter into valid contractual relations. The law renders three classes of persons incompetent, namely, infants, insane persons, and drunken persons. At common law married women were included in this class but contractual disability has now been practically universally removed by legislative enactment. The contracts of infants, insane persons, and drunken persons are voidable at their option except such contracts which are created by law, or quasi contracts Consideration is that which moves from the promisee to the promisor, at the express or implied request of the latter, in return for his promise. As the term is used in the law of contract, it means a "valuable" consideration; that is, something having value in the eye of the law. An agreement is not enforceable at law, and therefore does not result in a contract, if its object is illegal, such as agreements in violation of positive law; and agreements contrary to public policy.

A contract may be oral or written, expressed or implied, executed or executory. An executed contract is one where everything is done at the time of agreement, and no obligation is assumed; an executory contract is one where an obligation is assumed by one or both parties to do or forbear from doing some act.

The famous statute of frauds was enacted in England

in 1677, and is substantially followed by the statutes of most of our states. Section 4 of the statute provides, among other things, "That no action shall be brought upon any agreement that is not to be performed within the space of one year from the making thereof, unless the agreement upon which such action shall be brought, or some memorandum or note thereof, shall be in writing, and signed by the party to be charged therewith or some other person thereunto by him lawfully authorized." Thus it will be seen that a contract impossible of performance within the year must be in writing to be enforceable.

The above outline will furnish a knowledge of the law of contracts sufficient to put the average employer on his guard when entering into contractual relations with his employees. The decided cases which follow, cited as examples of the applied principles and stripped of all legal technicalities, should augment that knowledge enough to provide a working basis for his future conduct.

Letter May Be a Contract

A contract to be enforceable need not be drawn up formally or contain customary phrases such as "party of the first part." In fact an ordinary letter may include all the essential elements of a valid contract.

In a New Jersey case, decided by the Court of Errors and Appeals, Nov. 20, 1922, plaintiff received a letter from the comptroller of defendant corporation which stated in part:

"Confirming the arrangements made with you at our conference last Tuesday, we engage your services as assistant comptroller in charge of factory accounting, with a salary at the rate of $7,500 per year, with the understanding that, if the connection proves satisfactory, the salary, beginning January 1, 1921, will be at the rate of $9,000 per year. In further confirmation of our arrangements, it is understood that the company will pay the expenses of moving your household effects from Cleveland."

The plaintiff began his work and was paid at the rate of $7,500 until Dec. 31, 1920, then at the rate of $9,000 until the end of February, 1921, when he was discharged for no fault. Defendant contended that the employment was at will and the plaintiff maintained that it was a hiring by the year. The trial court left it to the jury, who found for the plaintiff, and defendant appealed. The court held that the letter alone, viewed as the entire contract, was properly to be construed as a hiring by the year. It then explained the difference between the "English view" and the "American view," the former tending to a construction establishing a contract for a definite term, if this can be spelled out of the language used, and the latter tending toward a holding that the hiring is at will, unless the hiring be fairly plain. The cases of that state favor the English view, and thus the employer could not, for no fault, legally discharge the employee before the expiration of a year.

A promise made to an employee which is not a part of the original contract of employment may constitute a separate or supplemental contract and become enforceable when the employer refuses or fails to fulfil it.

In a Washington case, decided by the Supreme Court, July 6, 1923, defendant company were shipbuilders with a contract with the United States Shipping Board for the construction of certain vessels. On Dec. 23, 1918, this company put out a statement to the effect that it wished to induce general department foremen in its employ to continue with it and to refrain from accepting employment elsewhere until the completion of that contract. To this end it promised "the general department foremen now in its employment that upon the completion of its contract with the Shipping Board the company will divide as a bonus one-half million dollars among those of its general department foremen who continue in its employment until the completion of that contract." Plaintiff was one of these department foremen and alleged that he relied upon this promise and remained with the company continuously until October 15, 1920, when the contract referred to had been completed. He stated also that he would not have so continued except in reliance upon the promise, and that he had not been paid the bonus. In order to enforce the promise referred to plaintiff had brought action in the Superior Court of King County, where judgment was in favor of the company, and plaintiff appealed. The supreme court of the State reversed the judgment of the court below, holding that the promise was a binding one by reason of its acceptance by compliance with the terms created therein. Such compliance "created a unilateral contract which is binding upon the offerer." Continuing the court said:

"The promise here was therefore no 'nudum pactum' on that theory, nor is it one on the theory that the promise was one for additional pay to be given one already under contract to do the very work for which the additional pay was promised. The complaint shows that the appellant was free to quit his work at any time, and therefore was under no obligation to do the thing which the respondent was seeking to accomplish by its offer. The compliance with the terms of the offer created a contract supplementary to the contract of employment. By this supplementary contract the respondent agreed to reward the appellant for remaining in its employ and refraining from 'accepting employment elsewhere until this company shall complete the ships'."

This case shows the distinction between the promise of a gift to an employee for what he is obliged to do, and a promise of a bonus for doing what he is not obliged to do. Unless the contract of employment provides to the contrary an employee is no more legally bound to remain with his employer than the employer is legally bound to retain him. But where a promise is made as consideration for continued employment and the employee in good faith accepts and acts upon that promise, the employer may experience difficulty in repudiating it at a later date without incurring liability.

Contract May Act as a Boomerang

Frequently an employer does not fully realize the possibilities that can arise as a result of the wording of a contract of employment. He may believe that he is binding the employee very shrewdly but later discover that in lieu of binding the worker he has, as a matter of fact, bound himself.

In a Georgia case, decided by the Court of Appeals, Feb. 9, 1923, a contract of employment was entered into between the plaintiff company and defendant, which read in part:

"The above proposition is hereby accepted this 22d day of December, 1920, service to begin January 1, 1921, and to continue 12 months, conditioned on your conduct and services being satisfactory to us, we to be the sole judge in reserving the right to terminate this contract upon 30 days' notice at any time."

A dispute arose as to the construction of this clause when the employer terminated the contract and dispensed with the services of the employee solely upon the ground

that the company's financial interests made such action necessary. An action for damages was brought by the employee against the company and a judgment was rendered in his favor. The company took the case to the Court of Appeals. That court construed the clause above as not authorizing the employer to terminate the contract for the reason given. The court said that "the employer's right to be the sole judge as to conditions upon which he will terminate the contract must, if any effect is given to the provision that the employee's right to continue in service for the period contracted for is conditioned upon the employee's services being satisfactory to the employer, be exercised only as respects the character of service upon the part of the employee, of which character of services the employer is to be the sole judge." A contract worded as above that employment is conditioned on one thing, such as satisfactory conduct and service, precludes the employer from discharging the employee before the expiration of the contract for any other cause than that stipulated, and even should the financial condition of the employer warrant such discharge he cannot successfully set up this fact as a defense. It might be of interest to point out that the phraseology used in effecting the discharge of an employee is just as important as that used in the contract of employment, for in this case it was the reason given for the discharge that brought about a judicial construction of the contract.

A contract may be oral or written, expressed or implied, executed or executory. A contract impossible of performance within the year must be in writing to be enforceable. A contract to be enforceable need not be drawn up formally. An ordinary letter may include all the essential elements to make it a valid contract

In a case decided by the United States Circuit Court of Appeals, Ninth Circuit, Aug. 1, 1921, the employment was conditioned upon the work being done "in an efficient and satisfactory way"—not to the satisfaction of the employer. The court said in part:

"The expression 'efficient and satisfactory way' is by no means the equivalent of 'satisfactory to the employer,' and, if the parties had desired that the latter meaning should be incorporated in the contract, it would have taken but a stroke of the pen so to express it. That not having been done, we must take it that the plain meaning of the expression used was the one intended."

Whenever, in the exercise of the right to discharge, the employer acts fraudulently, or so arbitrarily as to amount to a fraud, the employee is entitled to have the good faith of such act determined through the intervention of the courts. This was held in a Texas case, decided by the Court of Civil Appeals, April 13, 1921.

Too much stress cannot be laid upon the importance of the proper wording of contracts of employment. In fact, it is possible for an employer through carelessness, thoughtlessness, or haste to bind himself to his employee after that employee has quit his employment.

In a New York case, decided by the Supreme Court, Appellate Term, April 14, 1925, plaintiff, a former employee of defendant corporation, brought an action to recover commissions upon business obtained by him for the defendant under the terms of a contract which provided:

"We hereby agree to pay you a commission of 5 per cent on the amount charged by us for services rendered any customers brought to us by you, said 5 per cent to be your property, and to continue to pay this 5 per cent as long as we accept business from any of these customers."

Plaintiff claimed to have procured as a customer a certain firm prior to his discharge. The trial court allowed commissions on this account up to the time of the discharge, and plaintiff brought an appeal claiming insufficient relief. The supreme court noted that the contract specifically stated that the defendant is "to continue to pay this 5 per cent as long as we accept business from any of these customers." There being no suggestion that this obligation was conditional upon a continuance of plaintiff's employment to solicit business for the defendant, the court held that "when he procured a customer he was to get commission on that customer's business so long as the defendant continued to do business with that customer." The judgment was therefore reversed and a new trial ordered. The principle in this case is *res ipsa loquitur*. Because of the improper wording of the contract the employer found himself obligated to pay his former employee a commission so long as he (the employer) did a certain thing. If an employer in his contract of employment agrees to give the employee notice of dismissal he cannot violate his agreement without being liable unless the employee has committed some breach of discipline, duty or service.

In a California case, decided by the District Court of Appeal, April 8, 1925, plaintiff, employed as manager of a department for the sale and installation of drug-store fixtures by defendant company, was dismissed from his employment without notice. He brought an action to recover the amount of salary and commissions accruing during the 40-day period following his discharge, the contention being that the summary dismissal was in violation of the terms of the contract of employment. The trial court awarded a judgment on the verdict in the sum of $814.57, from which judgment defendant appealed. On this appeal the judgment below was affirmed. The main contention of the defendant company was grounded upon the principle of law (Civ. Code) that "it is the duty of the servant to obey all lawful and reasonable orders and instructions of the master, and that willful disobedience thereof warrants peremptory dismissal." The court found no evidence of such disobedience, and said:

"While it is doubtless the law, as appellant contends, that willful disobedience by the servant warrants peremptory dismissal by the master, nevertheless before the law will allow an employer to ignore the specific terms of a contract of employment, which requires notice to be given the employee of its proposed termination, it must appear that there has been some rule, order, or instruction of the employer violated, and that such violation was committed willfully and deliberately on the part of the employee.

"Although it is not necessary that the violation be perverse or malicious, or that it be the result of an evil intent toward the master, it must be made clear that the thing done or omitted to be done was done or omitted intentionally, the rule being grounded upon the theory that wilful disobedience of specific instructions of the master, if such instructions be reasonable and consistent with the contract of employment, is a breach of duty—a breach of the contract of service."

It frequently happens in a field of keen business competition that an employer, to protect his interests and the good-will which he has established, seeks by the contract of employment to prevent an employee from working for a competitor after the employee leaves his service. Especially is this so when the employer is engaged in a business which brings the employee in personal contact with the trade. A customer under such circumstances knows little or nothing about the employer —he deals exclusively with the employee, and when the service rendered has been honest and courteous the employee is not only given credit but a friendship arises which is sometimes very strong. As a result trade very often remains loyal to the employee after he changes his place of employment. To what extent an employer can successfully limit a former employee in this respect was very ably and concisely stated in a Massachusetts case, decided by the Supreme Judicial Court, June 8, 1922.

Plaintiff was the owner of a laundry in Weymouth, Mass., and had laundry routes in Weymouth, Hingham, and Braintree. On Aug. 7, 1917, he entered into a contract with one of the defendants under the terms of which the latter was to act as laundry solicitor, collector and deliveryman for the former. The term of the employment was to be at the will of the parties. Among its contract provisions was an agreement not to disclose the names, addresses, etc., of customers nor to permit anyone to accompany him on his route without the express permission of the employer; also not to do anything prejudicial to the interests of the employer for a period of three years after the termination of employment, nor to engage in the laundry business in specified territory for a like period. On Nov. 17, 1919, defendant in question was discharged for a justifiable cause. In the month of April, 1920, he became one of the incorporators of a laundry company. He entered into an agreement by which he could become half owner of the stock of the company. He gave information about customers to the company which he had acquired in the employ of plaintiff, and as a result of this information and because of the friendly acquaintance between defendant and the customers plaintiff lost a large part of his former business. Suit was brought for an injunction to restrain defendant from violating his contract and others from employing him. An injunction was granted, and the defendants appealed. In the Supreme Judicial Court the decree was modified and affirmed. The court said in part:

"It long has been settled that contracts restraining freedom of employment can be enforced only when they are reasonable and not wider than is necessary for the protection to which the employer is entitled and when not injurious to the public interest.

"Considering the nature of the business and the conditions now existing, the contract here considered was reasonable in limitations as to time and space. It clearly follows that defendant was rightly enjoined from soliciting within the towns of Weymouth, Hingham, and Braintree patronage of customers of the plaintiff, the names of whom had become known to him in the course of and by reason of his employment, and from disclosing the names or using, to the detriment of the plaintiff, information or knowledge regarding the laundry business which had been confidentially gained by him in the course of his employment. The decree, however, did much more than restrain him from doing any act or thing in derogation of his written contract.

"In these respects the decree was wrong. Notwithstanding his contract, the employee had the right to engage in the same line of business or to be interested therein, but not beyond the bounds defined. The measure of relief required must be determined by the facts."

The above principle applies equally well to the protection of trade secrets. In a New York case, decided by the Court of Appeals, Jan. 23, 1923, the employees concerned contracted that "under no circumstances nor at any time" would they engage in any similar business or disclose the secrets of the process of the business. The court held that "as to the restrictive covenants contained in the contracts, it is well established that equity will not enforce them specifically except to protect plaintiff's trade secrets. An employee will not be perpetually restrained from working for another except to prevent breach of confidence as well as breach of contract. The surrender for an unlimited time of the right to use the skill, knowledge, and experience which a workman brings to the services of his employer as a condition of such employment has never been enforced by injunction." To avoid pitfalls with their attendant and resulting consequences, employers will do well to give serious and deliberate thought to the contract of employment—the first step in the legal relationship of employer and employee.

On the Way

How the Lancia automobile is built will be told in a series of automotive production articles to be begun soon.

As has been announced, the first of several strong articles giving the facts on ***"What Modern Equipment Has Done,"*** will be published next week. The other articles in this group will appear from time to time.

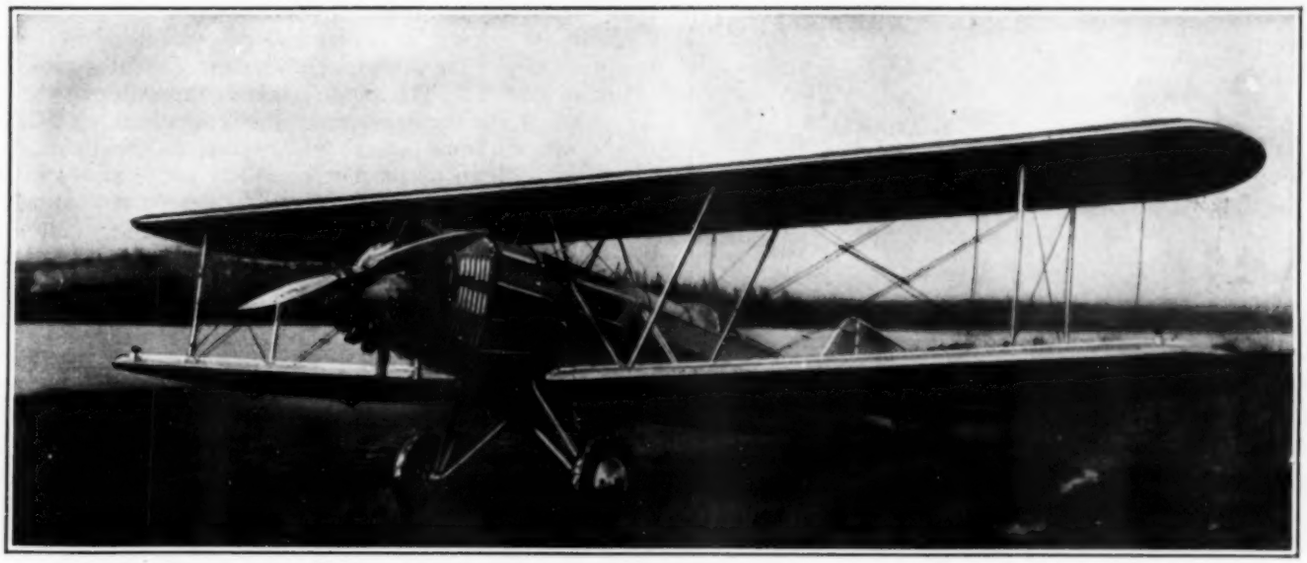
"Mr. Holland" will hold forth each week from now on.

Al and Ed will continue their discussions of ***problems vital to foremen.***

More good jig and fixture material, articles on gears, heat-treating, finishing, and so on, are on the way. Of them, more later.

Where workmen do their work in such a way as to require little supervision and the minimum of inspection, overhead expense naturally drops and profits increase. The more carelessness and lack of training amongst the men in the shop, the more "overhead" that is required, and the less chance of increasing wages. Every employee pays for superintendence and inspection.

Automotive Production



Boeing mail plane with 425-hp. "Wasp" engine, ready for flight

The Air-Cooled Radial "Wasp"

By ELLSWORTH SHELDON
New England Editor, American Machinist

Testing motors under flying conditions

BEFORE leaving the hands of their builders, all "Wasp" engines are given a thorough test under conditions approximating as closely as possible those to be met in actual flying. For the purpose of this test there are in the rear of the factory yards a number of test houses in which the engines are mounted, each in a separate chamber, and run for several hours under their own power.

The first house to be erected, shown in Fig. 67, will serve to convey to the reader a general idea of the arrangement, though several changes have been made in the newer ones. The engine is mounted upon a frame, called the torque stand, in the larger room of the house—which is 12x20 ft. in size and 10 ft. high—while the instruments with which the observations are made are located in the smaller extension, separated from the test chamber by a brick wall in which there is a small door to give convenient access to the chamber, and also a large window through which the engineer in charge of the tests may keep the engine under close surveillance as he sits at his desk.

The large outside door to be seen at the right in the illustration provides ingress to the chamber for the purpose of bringing in the engine. This door, as well as the smaller door and the window in the dividing wall are kept closed during a test run, thus converting the chamber into an air tunnel, drawing air through the roofed stack to be seen at the right and discharging it through the open stack at the opposite end.

Changes in the newer test houses, a group of which may be seen in Fig. 68, include making them double, so that one connecting wing serves to house the controls and instruments for two chambers; building the stacks higher and discarding the roof over the intake stack, which was found to be unnecessary; tilting the discharge stacks to deflect the current of air over the intakes, thus lessening the disturbance of the air outside the buildings; and making the stacks with double walls, packing material in the spaces between them to deaden the noise caused by both the rapidly running machinery and the vibrating air currents.

Extending under the floors of the row of test houses is a tunnel, covered both in the test chambers and the instrument rooms with loose planks so that it is accessible from any point within any of the houses. In this tunnel are pipes for steam, water and air under pressure; for oil and for gasoline; and cables for electric current, all of which are available to the test chambers and instrument rooms whenever and wherever they may be needed.

The twelfth and concluding article.

Automotive Production

Fig. 67—The first test house. A brick wall in which there is an observation window divides the test chamber from the control room

In the tunnel under each house there is a small tank through which the lubricating oil used in the engines may be made to pass, and in each tank are coils of pipe for steam or water, so that the tank becomes either a heater or a cooler, according to the setting of the control valves. The valve stems pass through the covering of the tunnel and terminate in handwheels beside the observer's desk.

On cold mornings it may be desirable to heat the oil to somewhere near working temperature before starting the engines, but after they have become warmed up, water is substituted for steam in the coils, and the main function of the small tank is to keep the temperature of the oil down.

The engine under test draws gasoline from an elevated tank outside the building, so that the fuel flows to it by gravity. On each engine there is a pump by which the gasoline is supplied to the carburetor, but the gravity supply to the suction side of this pump avoids fluctuations that would be likely to occur if the pump were obliged to lift the fluid. A separate motor-driven pump fills the elevated tank from an underground receptacle, the pipes to which are laid in the tunnel.

The torque stand on which the engine is mounted is a cylindrical frame of steel, supported at each end of its diameter upon roller bearings so that it is free to rotate about a horizontal, longitudinal axis. The engine to be tested is bolted to the front bulkhead of the cylinder, exactly as it will later be secured to the frame of an airplane. The center line of the engine crankshaft when so mounted is coincident to, and is an extension of, the axis upon which the barrel-shaped frame turns.

Resisting the tendency of the frame to rotate in a direction opposite to that of the whirling propeller, the balanced torque-arm *A*, Fig. 69, extends through an opening in the dividing wall to the instrument room where its free end is attached to a spring weigh-scale to register the reaction that is a factor in computing the power of the engine, and which in an airplane must be continually resisted by the setting of the wing controls in order to keep the plane from turning over.

All connections to the engine—fuel, lubricating oil, water, exhaust, manual controls, and the active ends of the various observation instruments—are flexible, so that resistance to reverse rotation of the stand is effective only through the torque arm. The four-blade stub propeller here shown is employed in all tests. The temporary exhaust manifold *B* is connected by a flexible metallic hose to an underground conduit that carries the burned gases to an outlet above the roof.

While the engine is running, water is admitted to the manifold to cool the gases and assist in muffling the noise of the explosions. The vaporization of the water by the hot gases causes the exhaust to appear as steam when it finally escapes from the exhaust stacks. In the illustration, Fig. 68, two of the test chambers are occupied by running engines, as may be seen by the steam floating from the exhaust stacks.

The interior of one of the instrument, or control, rooms may be seen in Fig. 70, with the observation window swung open to permit a view of the engine on its torque stand. The end of the torque arm is visible at *A*, with its connection to the spring scale by which the reaction is measured. The scale is anchored to the floor through a dash-pot in order to absorb vibration.

At *B* in this illustration is a tachometer to indicate the speed of the engine at all times and also to count the revolutions. At *C* and *D*, respectively, are gages to indicate the pressure of the lubricating oil as it discharges from the pump to the bearings of the engine, and of the gasoline as it is delivered to the carburetor. The three dials in the lower row are distance thermometers, the bulbs of which are located, respectively, in the carburetor to indicate the temperature of the incoming air; in the discharge port of the oil pump to show the temperature of the lubricating oil delivered to the bearings; and in the stream of returning oil to indicate the rise in temperature of that fluid in its passage through the engine. This latter indication is an effective measure of the internal heat of the engine. The small dial at the center of the board is a clock.

The long, graduated glass at *E* is a mercury gage connected to the intake of the engine between the carburetor and the fan of the supercharger to show the density, or barometric pressure, of the mixture at that point. By manipulating a valve, this gage may be made to register the same condition in one of the inlet pipes near the intake valve. In the newer test houses two

Fig 68—The group of new test houses. Each house has two test chambers and in the connecting wing are two sets of instruments

Automotive Production

separate gages are employed, thus showing continuous readings in both places. At *H*, on the board to the left of the window, may be seen three levers, one of which operates the engine throttle and another advances or retards the spark. The third lever regulates the mixture of air and gas delivered by the carburetor. The rectangular tank at *J* contains the lubricating oil that is circulated through the engine during the test. The suction and discharge pipes to this tank pass through holes in the cover, but do not touch it, so that the weigh-scale upon which the tank rests enables the observer to calculate the amount of oil that is consumed during a run. This oil is circulated by the engine pump, but passes through the cooler under the floor so that its temperature may be regulated. On the wall at *K* is a gasoline container, also resting on a weigh-scale and free from pipes that would interfere with its weight. The single pipe entering through the neck of the container is used for both suction and delivery. Through it gasoline may be pumped into the container from the underground tank or drawn to the carburetor by the engine pump. A three-way valve determines the direction of flow.

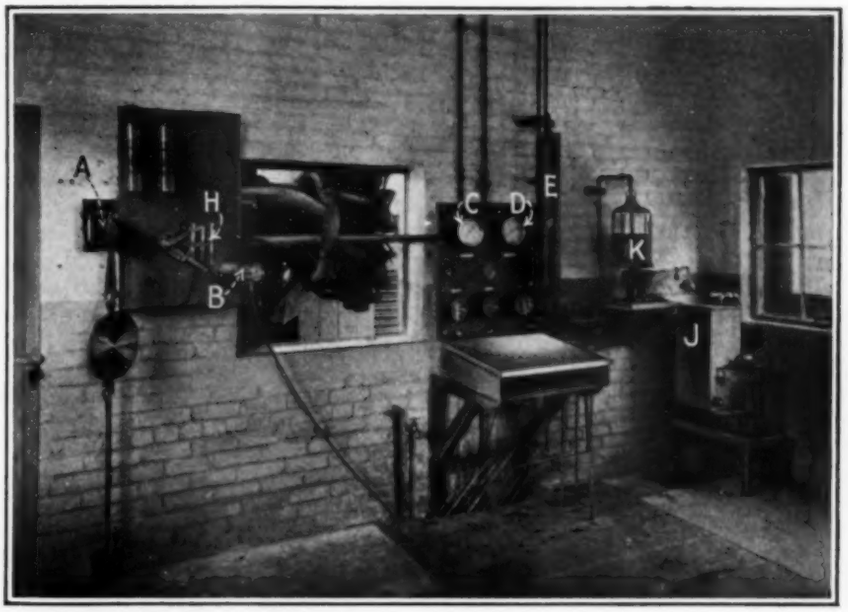


Fig. 70—Interior of one of the control rooms. The engine is visible through the window. During a test run this window and all doors are kept tightly closed. The instruments are grouped about the desk

Ordinarily the gasoline comes to the engine from the elevated tank outside, but at intervals of 15 minutes during a test run, the engine pump is allowed to draw from the glass container for a short time in order to determine the exact rate of consumption.

The scale upon which the container rests is set so that a full container will overbalance it and the beam will remain up. At the proper moment the valve is manipulated to switch the draft of gasoline from the outside tank to this container. In a few seconds the scale beam will drop because of the lessened weight of the liquid as the pump draws from the container. At this instant the observer sets in motion the indicating hand of a stop-watch and immediately removes a five-pound weight from the scale beam, allowing it to rise.

When the beam again falls, showing that the engine has consumed 5 lb. of gasoline, the watch is stopped and the valve is again reversed to allow the engine to feed from the outside tank. Knowing the elapsed time during which the engine has consumed a definite quantity of fuel, and from the other instruments, the amount of power the engine is developing, it is a simple calculation to determine the fuel consumption per horsepower-hour.

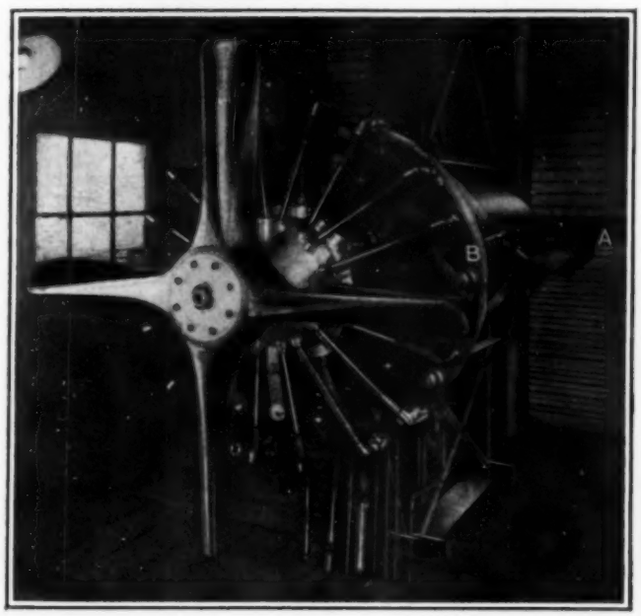


Fig. 69—The engine is mounted upon a cylindrical frame of steel that is carried in roller bearings and is free to swing about a horizontal axis. The turning moment is resisted by the long arm that extends through the wall

A test run may be said to be dividid into several periods. The first period is that in which the engine is run by power, other than its own, on the stand in the assembling room. It then goes to the test chamber for its preliminary run of eight or nine hours, during which it is started at slow speed and the speed is gradually increased until toward the end of the run it has reached practically normal operating speed. The engine is then returned to the shop to be cleaned and inspected.

After being reassembled it is again returned to the test chamber for its final run before shipment. This time all of the instruments are attached and observations are taken over a period of four or five hours, during the latter part of which the engine is developing full power. Observations made at this time are recorded on the official log, from which the power developed, the fuel and oil consumption and other data required to make a complete record of the performance, are calculated.

The illustration at the head of this article shows a "Wasp" engine mounted at the nose of a Boeing mail plane, ready for service.

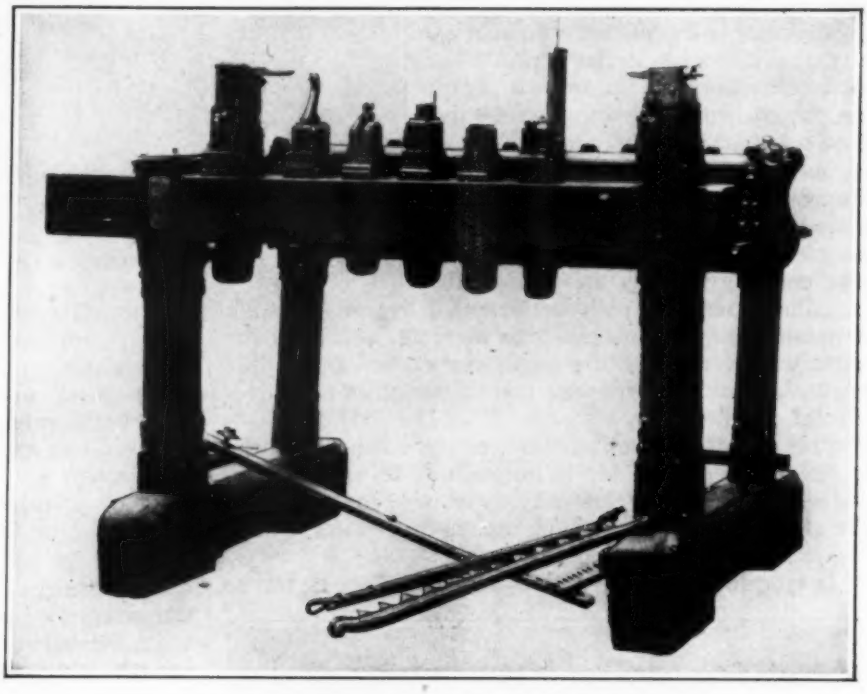
An Ancient Lathe

By L. L. Thwing

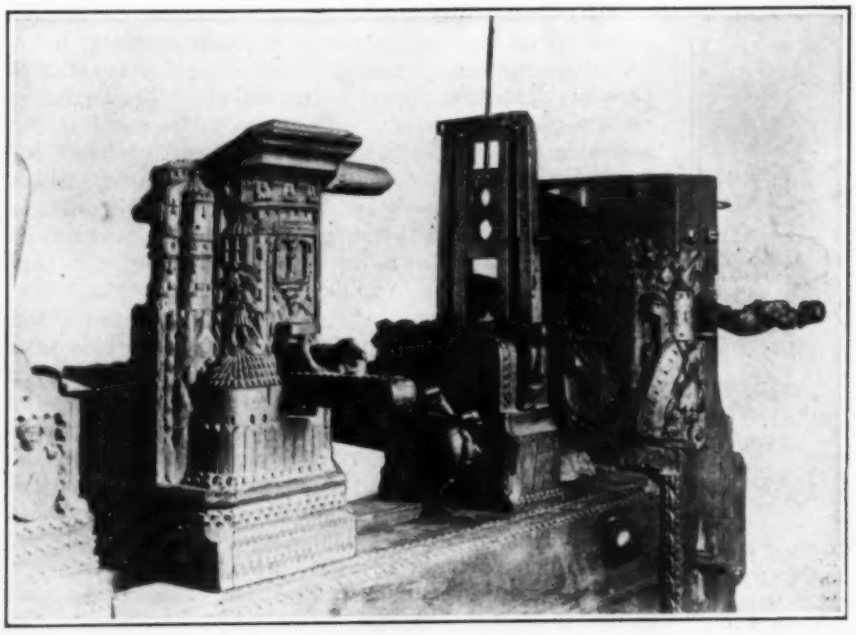
WHAT is probably the oldest lathe in existence is shown in the accompanying photographs. Medieval lathes were constructed almost entirely of wood, and as a result, very few have been saved for us. The fact that this lathe has been preserved is because it belonged to an emperor, and also because of the unusual nature of the carving. It was presented to the Holy Roman Emperor Maximilian I about 1500. Maximilian has been described as the last of the knights and the first of the artillerymen, as it was about this time that gunpowder began to assume importance as a munition of war.

In the year 1500, and for more than 200 years after that, the standard form of lathe used in Europe was substantially as shown here. With the exception of the centers, it was made entirely of wood. The head and foot stocks were clamped to the bed with wedges. In the lathe shown, the headstock is fixed, being a part of the support, or leg. Both centers have a longitudinal adjustment. The fixture in the center of the ways is a steadyrest. Such work as could not be turned on centers was turned by using a mandrel with one free end supported in the steadyrest, the other end being held against the head center. Screw and shell chucks were driven on the free end, and turned as any wooden piece would be today, but with the exception that the work revolved toward the operator for a few turns, and then reversed, making continuous cutting impossible.

The driving was done by a cord wound once around the work. One end of this cord went to a foot treadle, and the other to a horizontal spring pole overhead. The operator thrust down with his foot, and advanced his tool at the same time. When his foot hit the floor, he backed his tool out, and the spring pole lifted the treadle for another stroke. This in-and-out motion of the tool was one reason why the sliderest was not invented until Maudsley's time. In the 15th century, a German engineer had sketched a sliderest, but it had only a cross-slide, and did not have longitudinal motion or carriage. In order to hold the body steady when balanced on one foot, a rest was provided against which the turner could steady himself and have his hands free to work.



The lathe shown at the right, more than 400 years old, has the basic principle of the modern lathe, but the necessity of driving from the work without continuous power made turning a laborious process. The foot treadle, with cord, gave only a back-and-forth motion



Machine tools of the middle ages apparently were considered as articles of furniture, as is seen by the intricate carvings on the lathe shown at the left. All parts of the lathe, except the centers, are of wood. The head and foot stocks were ornamented with typical medieval designs. The steadyrest in the center would be considered good design today under the same operating conditions, and it served as a bearing for turning work that could not be held on centers

· EXECUTIVE · FORUM ·

Executives are invited to discuss the problem involved in the following case
Accepted contributions will be paid for

NEW EQUIPMENT VERSUS EXPANSION

TO EXPAND or not, that was the problem for George Brower, owner and manager of a nice little business that was crowded with orders. So much so that he had applied to his bank for a sizeable loan to enlarge his plant. Before advancing the money the bank president had asked William Holland to look the plant over and to talk with Brower as to the whole situation.

"Well, what do you think, Mr. Holland—you can see that I need a bigger shop, I'm sure. Here are the advance orders." And he handed over an array that would please even a confirmed pessimist.

"You surely need more capacity, Mr. Brower. Just how do you propose to get it?"

"I want to build on the back end and put in more machines. Seems to be the only way, doesn't it?"

"Can't quite agree with you there, Mr. Brower, though it's the way that usually comes to mind first."

"But how else can I get more production—you just said I needed more room—"

"Not exactly, Mr. Brower, I said you evidently needed more *capacity*—not more room. People sometime confuse the two."

"I don't quite get you, Mr. Holland."

"I've seen so many cases of over-expansion, Mr. Brower, that I'm a bit shy about adding space unless it becomes absolutely necessary. There are too many over-expanded plants today, hustling to find any old kind of work to keep them busy."

"I'm still in the dark, Mr. Holland."

"I took careful note of your machine equipment, Brower. And while it isn't very old, there are so much better machines now available that many of yours are back numbers. Take that coupling pin you are grinding between centers. A new centerless grinder can shoot them through three or four times as fast. And it's the same with a number of your other operations."

"But those machines are not old, as you said. Don't want me to throw them out, do you?"

"That's exactly what I do want, Mr. Brower. You can probably get some salvage from them. But if you can't, you can scrap them and still be money ahead of the cost of enlarging the plant. Seems to me your situation is much like that of the Ames Company over in Harrison where I spent some time last spring. The manager found that for the money he wanted with which to enlarge his building he could replace enough machines to about double his output. And while he had increased his investment he had no larger buildings to heat, to keep in repair and to pay taxes on. He also reduced his labor costs, and his power bill was somewhat less than had he added to the number of machines. He's going to make money this year."

"That's a new way of looking at it, Mr. Holland. May be good dope for me, too. In other words he found it better to keep a plant small and filled with highly efficient machinery than to keep machines that are less productive than the newer machines.

"You see, Mr. Holland, I was brought up with the idea that thrift meant hanging on to things as long as they could be used. I've kept my machines in pretty good shape and I hadn't even thought they should be disposed of."

"Glad you've got the idea, Mr. Brower. The Ames Company found that the smaller the plant can be kept and yet turn out what you need, the better. It takes less supervision, in addition to the other things I mentioned. They considered it better to take care of peak loads with a little overtime, with all its disadvantages. I think they're right. I've seen so much grief from over-expansion that I'd do a lot to avoid it."

Power and Ram-Box Work for Stokers

THE methods used by the American Engineering Co., Philadelphia, Pa., in machining units of its power stoker include the extended use of grinding for flat surfaces. One such operation is shown in Fig. 1, where the back surfaces of a string of six power-boxes are being ground on a Diamond machine equipped with a 36-in. sectional wheel. The first operation is to grind the angular mating surfaces of the boxes and, after drilling the bearing bolt holes shown at *A*, the boxes are mounted on the fixture shown, being located by two dowels in the end flanges. The first grinding is done one at a time. The height of the bearing from the base is important, and the center distance is held within 0.010 in. There is a third surface to be ground, the complete grinding operations requiring 66 minutes.

Fig. 1—Surfacing six bases at once

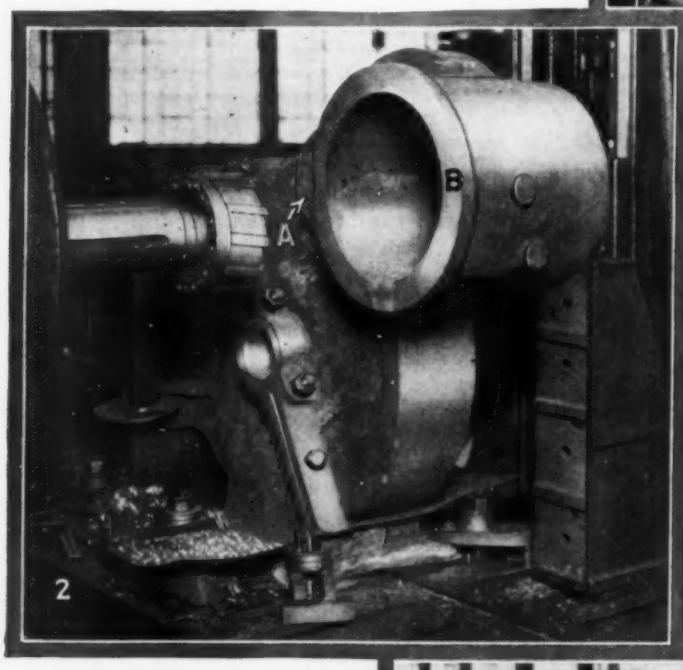


Fig. 2—Two halves of power boxes bolted together and mounted on Bement horizontal boring machines. Here the shaft bearing and the large openings are bored and the ends of surfaces *A* and *B* are faced with the milling cutter shown. Bores must be parallel within 0.004 in. in 3 ft. The large hole is 12 in. in diameter and is bored and reamed to within 0.002 inch

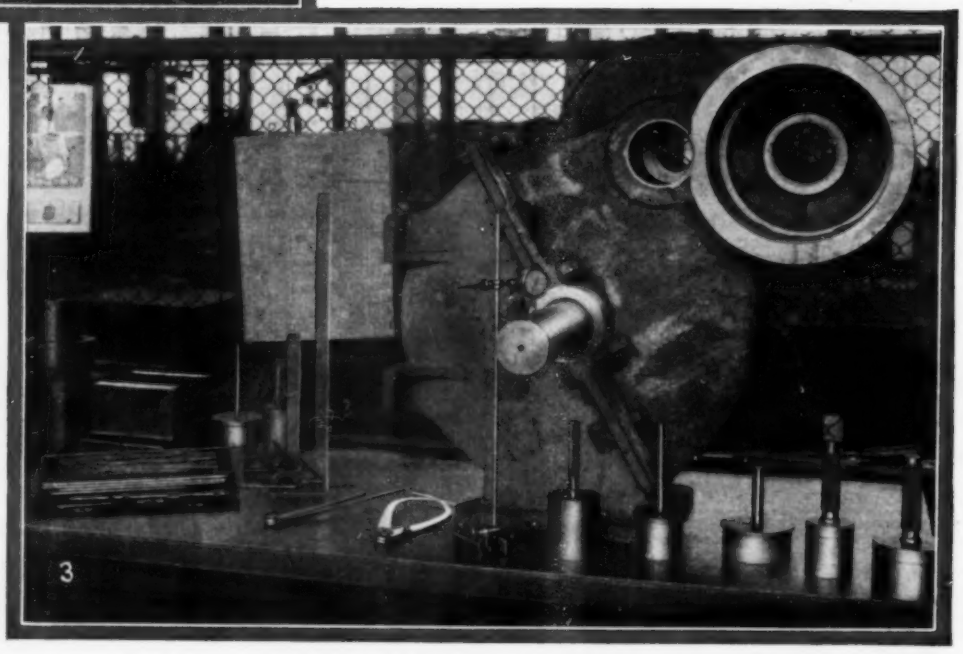


Fig. 3—Completed power box in the inspection room with gages and testing appliances. Dial indicator in surface gage shows center height. By turning box on the other finished surface, the shaft hole can be checked both ways. The other center distances and diameters are also inspected here

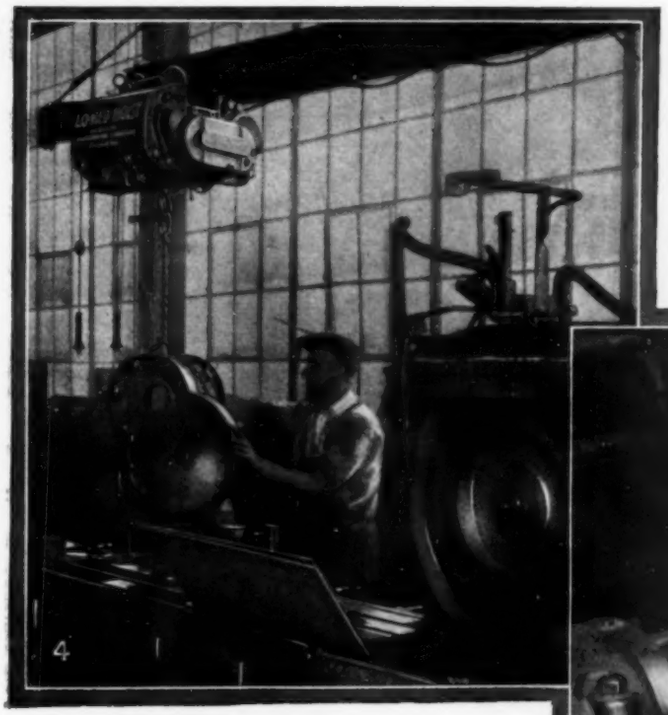
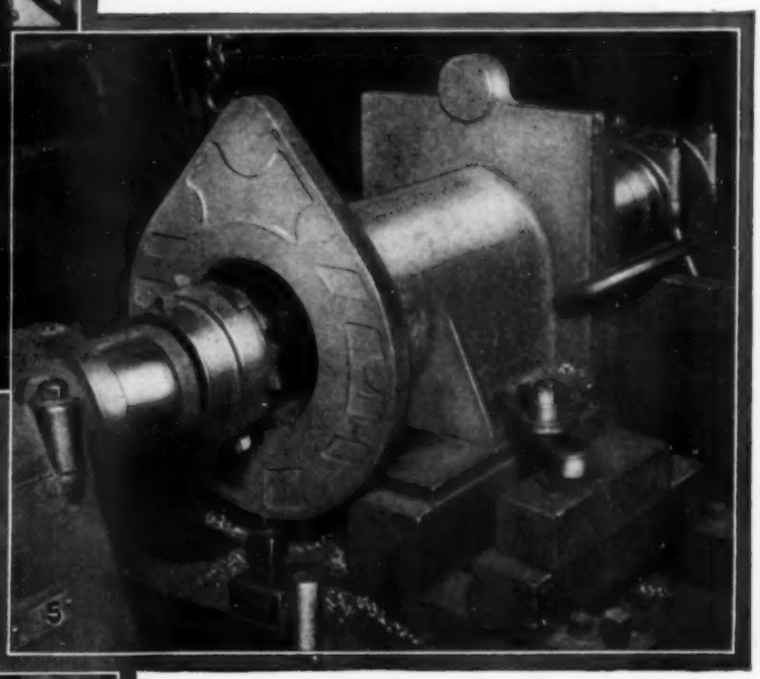


Fig. 4—Handling a ram box by means of a Lo-Hed electric hoist on a jib crane. This method enables the operator to locate the piece easily and accurately in the fixture on the table of the Diamond grinder, where the ends are ground square

Fig. 5—Here the ram box is being bored on a Barrett horizontal machine, using a boring head with inserted cutter blades. The piece is located by means of the flat side that rests on suitable blocking on the bed of the machine. Squareness is assured by clamping the end flange against an angle plate



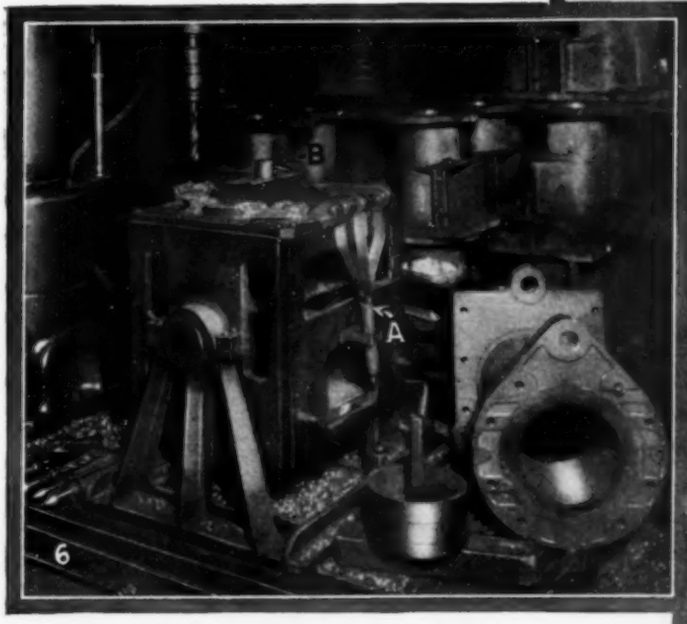
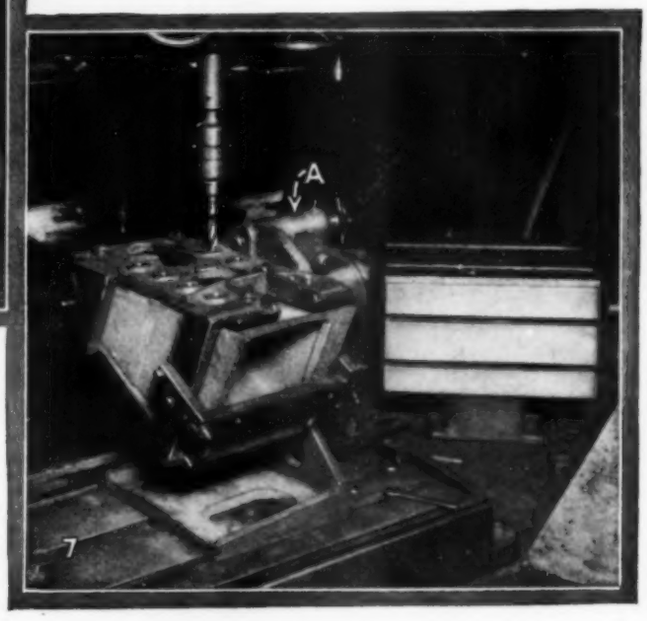


Fig. 6—Drilling the flange and other holes in the ram box under a Carlton radial drilling machine. The work is located by a plug *B* in the center, this plug being operated by the lever *A*. All the holes in both ends are drilled at this operation in the trunnion fixture shown

Fig. 7—This view shows another trunnion fixture in which the slide box is drilled on three surfaces. The work is well supported in the fixture. The trunnion is large and has a large flange for indexing by pin *A*. The fixture is easily handled and, owing to the taper sides, the work slides in and out easily.



Machine Work on Shafts and Rods

Photographs by courtesy of the
Worthington Pump & Machinery Corporation
Laidlaw Plant

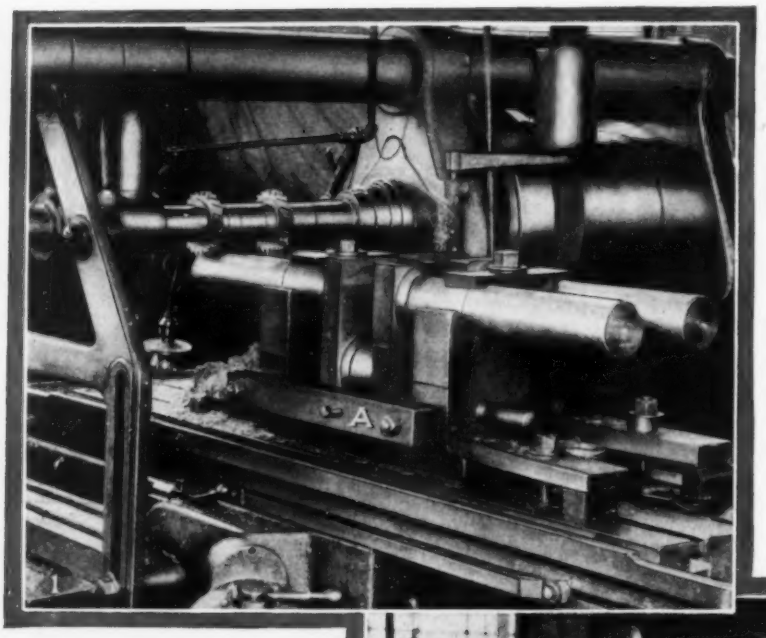


Fig. 1—Cutting keyways in two shafts at once. The shafts are held in V-blocks in a substantial fixture mounted on the table of a knee-type milling machine, and the keyways are located by swinging the sides of the crank cheeks against the bar *A*, a similar bar being provided on the opposite side

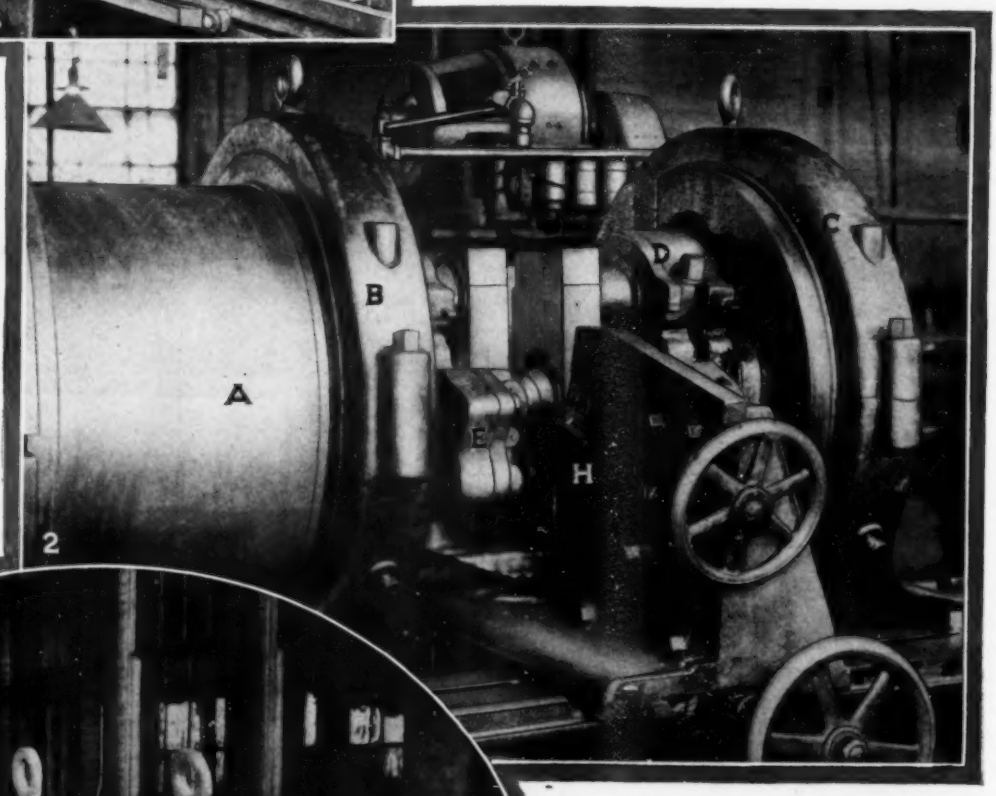


Fig. 2—Turning a crankpin. The crankshaft is held in a special chuck at *A*, the chuck revolving in a large outer bearing at *B*. The outer end of the crankshaft is supported in a similar bearing *C*, that is in reality a special steadyrest. The method of clamping the crankshaft is shown at *D*, and one of the counterweights is shown at *E*. The bearing is turned by a well-supported tool held in the special toolblock *H*

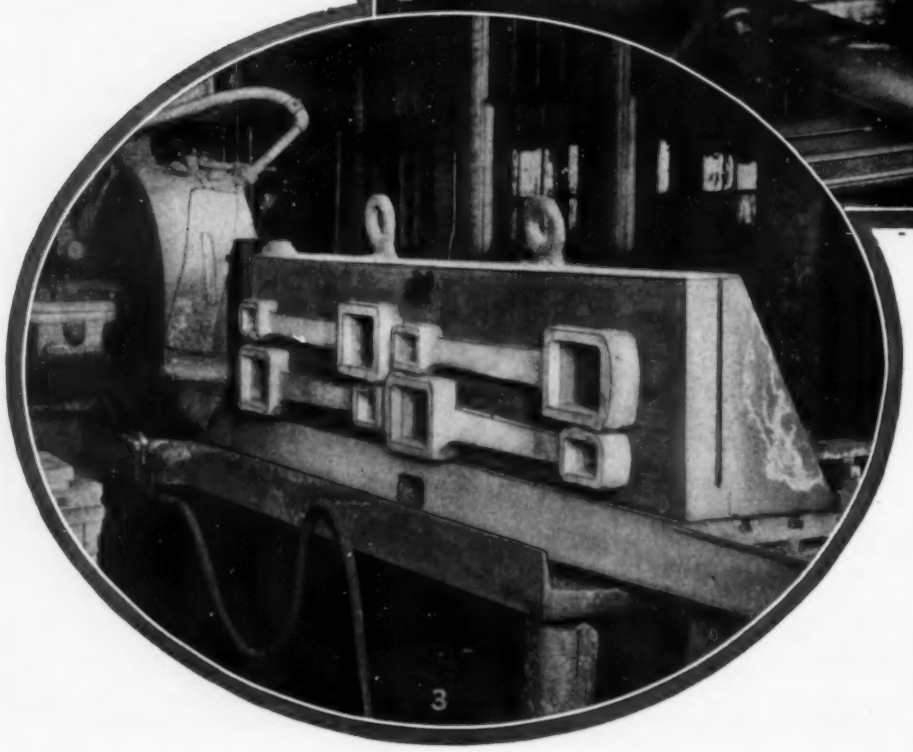


Fig. 3—Surfacing the sides of connecting-rod ends is done on a Diamond grinder, while being held on a large magnetic chuck mounted on the face of a long angle plate. By nesting the rods as shown, it is possible to bring the surfaces to be ground very close together

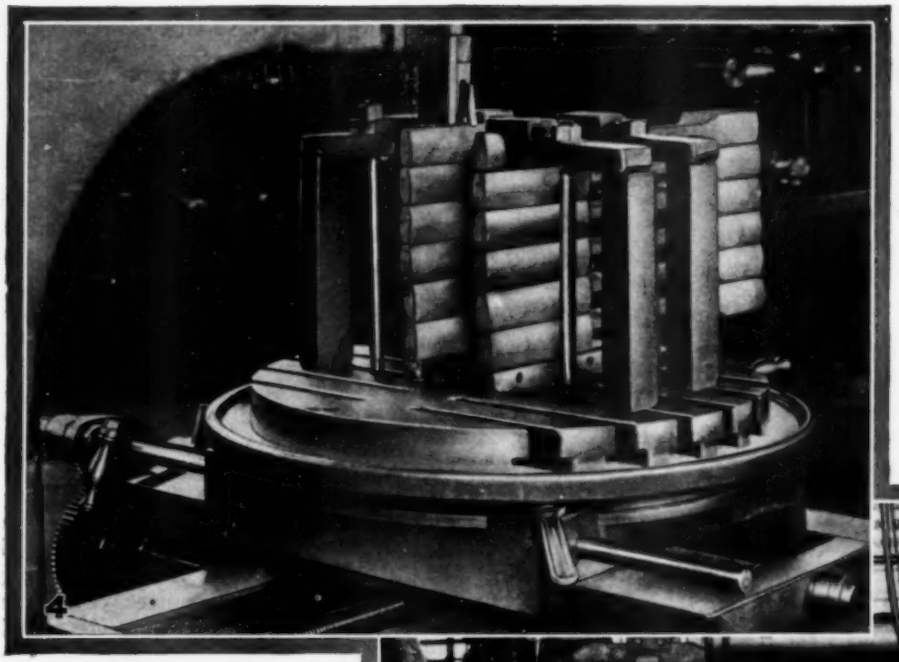


Fig. 4 — Slotting the forked ends of six special connecting rods. The connecting rods are stacked in proper alignment, the lower rod resting on parallels to allow clearance for the cutting tool. The tool bar is equipped with a clapper-box for relieving the tool on the return stroke. The offset clamps shown make it easy to hold the rods in position while being machined

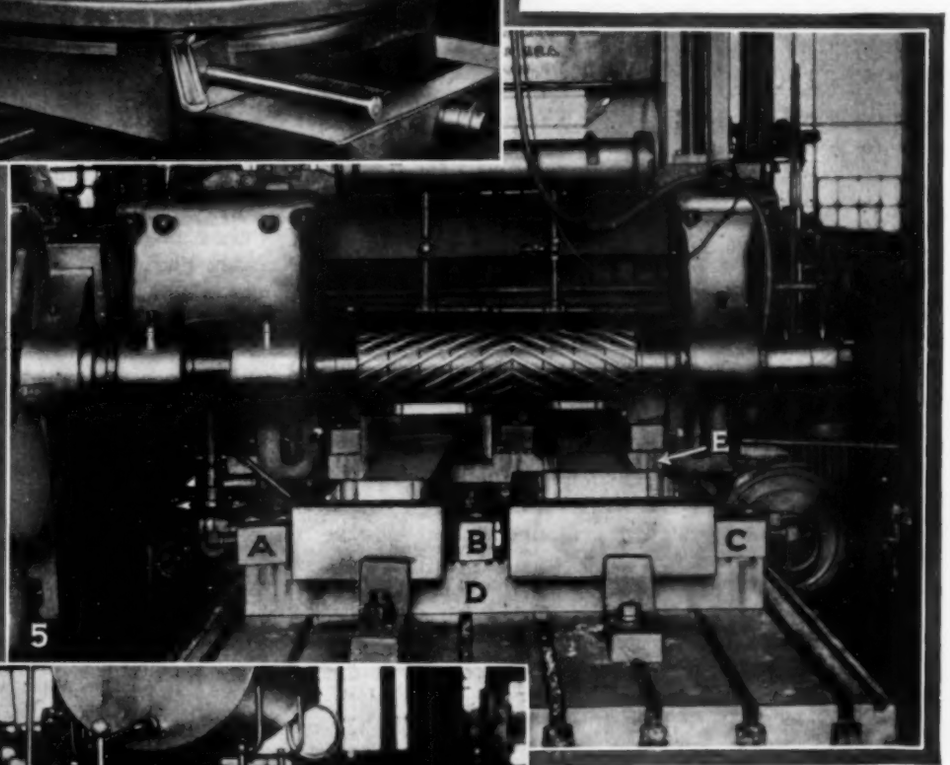


Fig. 5 — Slabbing the sides of connecting-rod ends on an Ingersoll milling machine. The rods are considerably larger than those shown in Fig. 3. The rods are clamped by screws in the blocks *A*, *B* and *C*. It will be noted that the crossbars *D* and *E* have keyways in the upper surfaces so that the clamping blocks can be held in position by keys

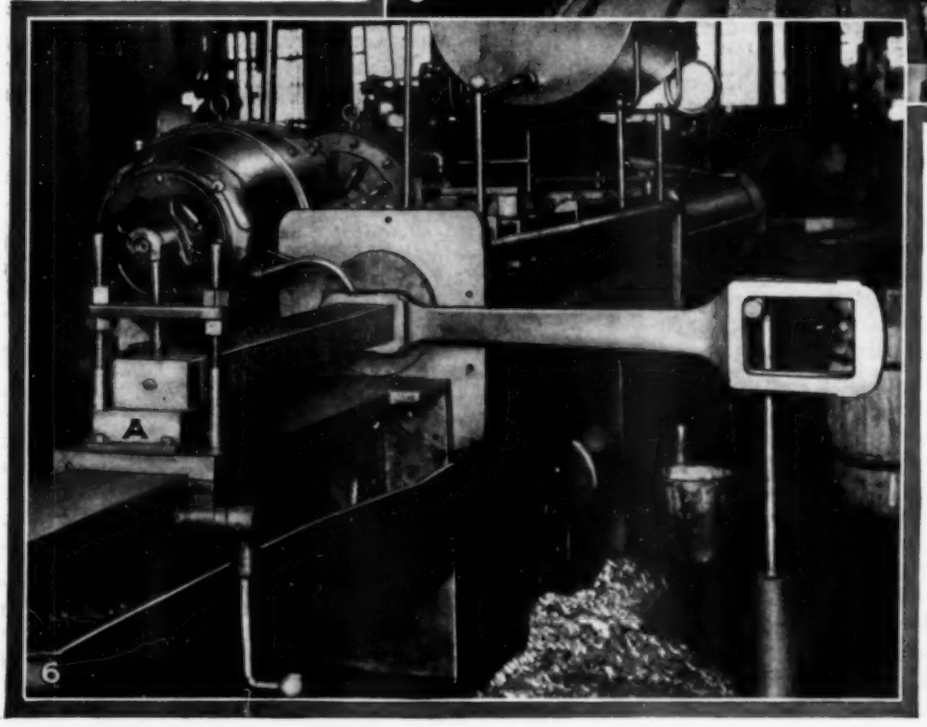


Fig. 6—Finishing the small end of a connecting rod on an American hydraulic broaching machine. The hole to be broached is unusually large, and it will be noted that the outer end of the broach is supported on the sliding shoe or crosshead *A*. This method of supporting the broach is to prevent it from sagging and causing inaccuracy of the hole being broached

Book Reviews

INDUSTRIAL TURMOIL. By Fred B. Jacobs. Two hundred and ninety-five pages, 5x7½ in. Published by Burton Publishing Co., Kansas City, Mo. Price $2.

USING the desirability of the open shop as a background the author weaves a novel around shop conditions in a New England town. He shows the results of niggardliness, shop spies and general ill-will on one side and an ill-advised strike on the other.

The author's shop experience shows plainly in the handling of shop descriptions and situations. The business ability of the old employer's daughter together with the loyalty of the employees to her methods of fair dealing, brings order and success out of chaos, distrust and threatened failure. There are few novels in which the atmosphere of the shop has been so well portrayed.

CORPORATION PROCEDURE. By Thomas Conyngton and R. J. Bennett; revised by Hugh R. Conyngton. One thousand, four hundred seventy-nine pages, 6x9 in., cloth covers. Published by the Ronald Press, New York. Price $10.

THIS volume is based on three books previously published, namely, "Corporate Management," by Conyngton; "Corporate Organization," by Conyngton; and "Corporation Accounting," by Bennett. The present volume is largely a consolidation of these three former works.

Its 165 chapters and 341 forms constitute a complete working manual for officers, directors, attorneys and others concerned with the management of corporate affairs. Every attempt has been made to make the book one which corporate officers will find desirable to keep constantly at hand for reference.

Among the subjects discussed are the corporate structure, preparation and filing of the charter and amendments, preparation of by-laws, the corporate control, the annual meeting, powers of directors, meetings of directors, liabilities of officers, the treasurer's official relations, the corporate funds, capital stock and shares, the use of no-par value shares, the stock certificate book, issue and re-issue of stock certificates, corporate bonds and notes, corporate organization, the corporation finances and accounts, combination, reorganization and dissolution.

POSTPONING STRIKES. By Ben M. Selekman, Department of Industrial Studies, Russell Sage Foundation. Four hundred and five 5½x8-in. pages, cloth board covers. Indexed. Published by the Russell Sage Foundation, New York, N. Y. Price $2.50.

EIGHTEEN years of Canadian industry's experience with the Industrial Disputes Investigation Act are summed up in this book. When the Disputes Investigation Act was passed it was vigorously opposed by labor, and the feeling in this country was that a compulsory measure of the kind could not wisely be adopted in the United States. For the past ten years, however, Canadian labor has in general favored the Act, and aided in its proper functioning.

The Act is aimed to prevent strikes by prohibiting their declaration until a report on the dispute has been made by a board of conciliation and investigation. On the other hand it prohibits employers from reducing wages or altering working conditions without due notice and a hearing.

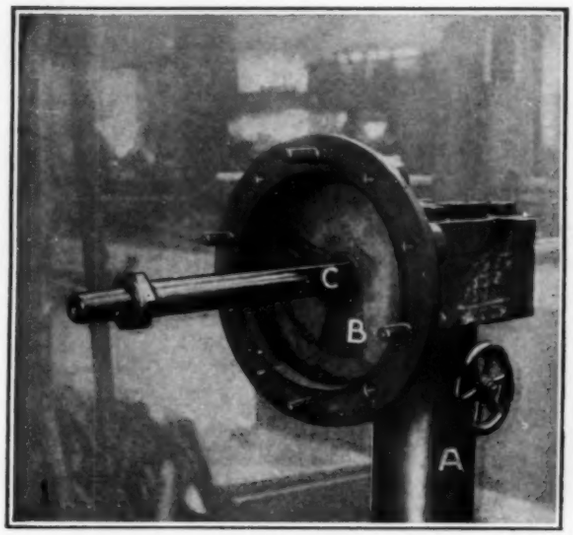
The book is divided into fifteen chapters. The purposes and provisions of the Act are taken up in the first two chapters, followed in the third chapter by a resumé of the history of the operation of the Act. The case is cited that of 429 disputes referred to the Ministry of Labor under the Act, 91 per cent were settled without a strike, and definite examples are given of the workings of the control administration. Other chapters cover the basis of board decisions, period of disapproval, criticisms, attitude of labor, and the significance of the Canadian experience. The complete text of the Act is given in the appendix.

ANNUAL REPORT OF THE BOARD OF REGENTS OF THE SMITHSONIAN INSTITUTION, 1926. Five hundred and thirty-five pages, 6x9 in., cloth board covers. Published by the Government Printing Office, Washton, D. C.

THE report shows the operations, expenditures, and conditions of the institution for the year ending June 30, 1926. Ten numbered appendices cover the individual reports on the various activities connected with the Institution. The general appendix includes scientific papers on many phases of natural science. The only one of particular interest to machinery men is that by F. L. Lewton on Samuel Slater and the oldest cotton machinery in America. Of more general interest are several papers on astronomy, and, to Easterners at least, one on fish that eat mosquitoes.

EXPORT DUTIES OF THE WORLD. Published by the Bureau of Foreign and Domestic Commerce, U. S. Government Printing Office, Washington, D. C., paper covers, 6x9 in., 211 pages. Price 35 cents. A tabulation of the practice of all commercial nations on the imposition of taxes upon the exportation of commodities from their territories. The purpose of this study is to present a factual statement of the export duties of all countries as they stood on Feb. 1, 1927. Among the important commercial countries, the United States, United Kingdom, Irish Free State, Germany, Netherlands, Denmark, Sweden, and Australia, impose no taxes, under whatever name, upon the exportation of commodities from their territories. In the United States the levying of export duties is prohibited by the Constitution. In contrast are those countries or colonies which levy export duties upon all, or most, products leaving their territory. This practice of general export duties is found principally in Haiti, Salvador, Argentina, Uruguay, and most of the states of Brazil; in Arabia, China, Egypt, Mesopotania, and Syria; in Albania, Bulgaria, Portugal and Rumania; in the Belgian Congo and certain of the colonies of Denmark, France, Portugal and Spain.

DIE ARBEITSGENAUIGKEIT DER WERKZEUGMASCHINEN. By Dr. G. Schlesinger. Forty 11¾x8¼-in. pages. Flexible imitation leather covers, with creased folds for pocket adaptation. This booklet contains directions for testing the accuracy of machine tools, and gives diagrams of the set-ups of gages for conducting the various tests necessary on milling machines, drilling machines, grinders, boring mills, lathes, and other tools. In each case the diagram shows the exact position of the test instruments for accurately gaging the surface. The parts to be tested include spindles, tables, ways, and such other features as affect the accuracy of cut of the machine.



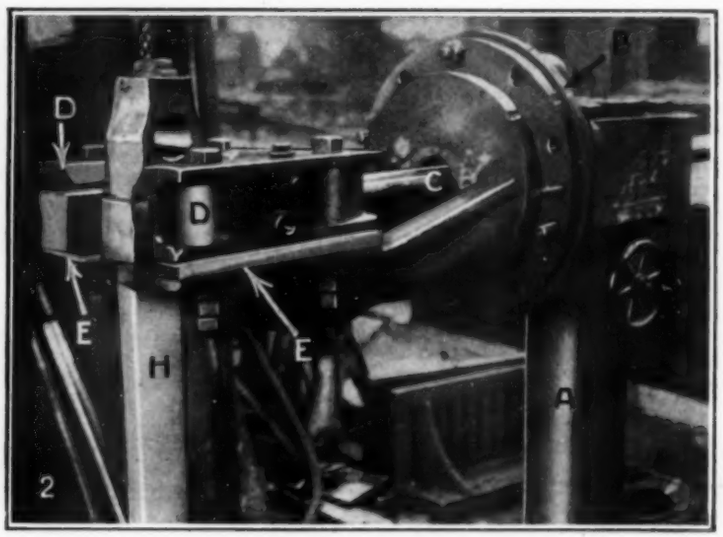


Fig. 1—Stand for assembling of the Walschaert gear. Fig. 2—Different sizes of locomotives with this type of gear

Time-Saving Devices in the Boston & Maine Railroad Shops

By ELLSWORTH SHELDON
New England Editor, American Machinist

In the long run any device that will save an appreciable amount of a workman's time, relieve him of arduous labor or enable him to do better work, is well worth its cost

SPECIAL devices designed to expedite the work of locomotive repair are employed on many jobs at the Billerica shops of the Boston & Maine Railroad. Some of them reduce the actual time required to do a given job; others save time by enabling the workman to do his work under conditions of convenience, and free from interference by, or interfering with, men engaged upon other work on the same locomotive.

Of the latter class is the device—indiscriminately called a "jack," a "stand," or a "jig"—shown in Fig. 1, on which the valve-rod guides, crossheads and combination levers of the Walschaert gear are assembled and aligned. This device is located in the motion-work department, and instead of waiting for an opportunity when the locomotive is for the moment clear of other workers in order to assemble the parts upon the engine itself, the workman puts them together right in his own bailiwick, and when he is through with the job he knows that the assembled unit will go into place on the locomotive without further fitting, and will work as smoothly as it did while on the stand.

The device consists of a standard, *A*, a casting *B* that is a replica of the end of the valve chamber on the locomotive, and a valve-rod *C* that stays right with the casting at all times. This stand is permanently fastened to the floor in a corner of the department. On the back of the casting *B*, and integral with it, is a smoothly turned shoulder that fits a large transverse hole in the top of the stand, and may be clamped firmly therein by means of a wedge operated by the small handwheel. There are as many of the castings *B*, each with its individual rod *C*, as there are sizes of locomotives of this type to be repaired.

The method of using the device is plainly to be seen in Fig. 2, where an assembled unit is shown in place. The head of the valve chamber is bolted to the casting *B*, which it fits exactly as it will later fit the flange of the actual valve chamber. The rod, a duplicate of the valve-rod belonging to the locomotive under repair, is pushed through the central hole of casting *B* and the crosshead is secured to its tapered end.

The guides *DD* are bolted to place, with the hardened steel wear-plates *EE* between them and the casting to which they are secured. These wear-plates are ground smooth on both sides, and several of them of different thicknesses are convenient to the hand of the workman. He can, therefore, without resorting to packing, select a pair of plates that, when the guides are firmly bolted

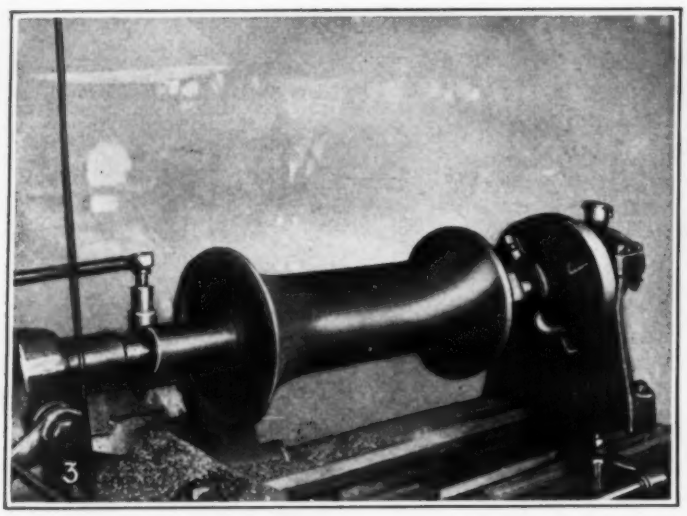


Fig. 3—Turning the spool of a piston valve in a lathe by means of a special mandrel. Two three-lobed steel spiders on the mandrel hold the spool between them by endwise pressure.

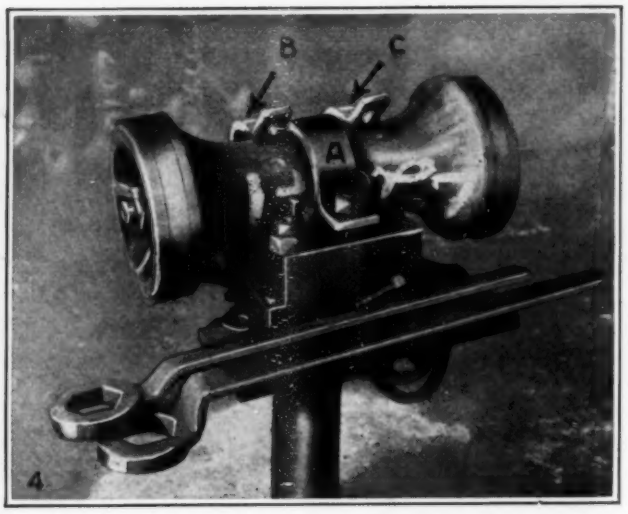


Fig. 4—This stand holds the spools of the piston valves while the valve is being assembled. It will hold any size of valve, three straps being provided

to place, will support the crosshead without shake and without causing it to bind the rod in the long hole through which it passes.

Similarly, the guides may be adjusted sidewise to confine the crosshead laterally, yet allow it to travel with perfect freedom. When such adjustment—not always necessary—is to be made, the guides are first secured by clamps and adjusted to position, after which the bolt holes are line-reamed with an expansion reamer.

The combination lever *H* and its fulcrum pin are then put into place and any adjustment is made that seems necessary. The workman may now cast loose and withdraw the rod, unbolt the assembled unit from the stand and send it to the erecting floor, confident that it will go into place without further attention.

The "spool" of a piston valve is a peculiarly shaped bushing of cast iron, machined on both ends to receive the small pistons that constitute the actual valve. As the machined ends of the spool must be in alignment in order to have the valve function properly, and as the bushing is not machined, either inside or out, there is a problem to be met in holding it for the necessary turning and recessing to be done at the ends.

The work has been done—and is still done in many shops—on a horizontal boring mill by means of fly cutters in the bar. While there can be no question of the accuracy of the boring-mill job, it is far less convenient and consequently more expensive without being more accurate than the lathe job done as here shown.

The mandrel to be seen in Fig. 3 has upon its middle portion two three-lobed spiders of hardened steel; one of them fixed near one end of the mandrel, while the other is free to slide upon it and is backed up by a large nut that is threaded to the body of the mandrel. The loose spider is removed to put the mandrel through the spool, after which it is replaced and the nut is screwed on. The spool is thus secured by endwise pressure between the two spiders and is handled on the mandrel as a solid piece.

Assembling the pistons with the spool on the valve rod is not a difficult job by any means, but, collectively, the part becomes a hard piece to hold against the torque of the wrenches, usually requiring two men to handle it. The stand shown in Fig. 4 is also located in the motion department and provides a means of holding the valve so that one man can assemble it without undue trouble.

The stand is composed of a piece of heavy pipe, secured firmly in the cement floor in an upright position, with a casting at the top that is, roughly, a V-block. Semi-circular bands of iron, *A*, *B* and *C*, are hinged to the block at one side, and when folded over the spool are secured to the other side by studs and nuts. The reason for the three bands is that there are several sizes of the spools to be held, and three bands are necessary to cover the range. Of course, but one band is used at a time.

The job of removing or resetting the flues in a locomotive boiler is not exactly a Sunday school picnic, at its best. Usually a platform of loose planks, laid upon wooden horses, is built up in front of the dismantled locomotive to hold the flues as they are taken out, and then there is the job of bundling and transporting them.

In Fig. 5 may be seen a platform built up especially for this job from bars of light structural steel. On top of it, at a height convenient to the work, is a wheeled cradle to receive the flues. Upturned ears at both ends of each side rail of the platform confine the wheels of the cradle against rolling off, and when the cradle is filled with flues, the sling chain of the big overhead crane is attached and it is lifted from the platform to be deposited upon any of the standard-gage shop tracks and wheeled to whatever point the flues are to be taken.

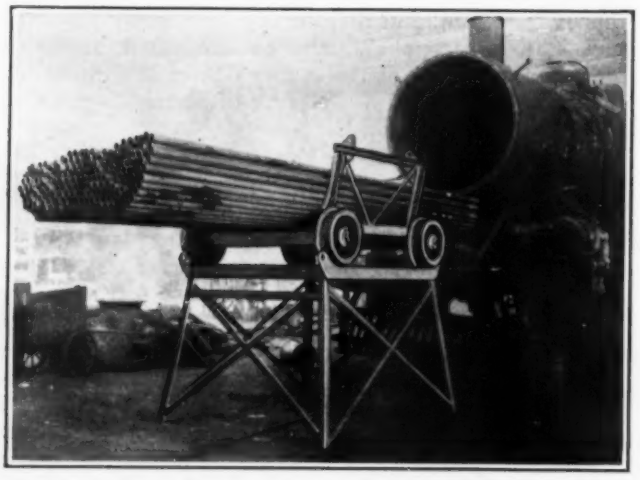
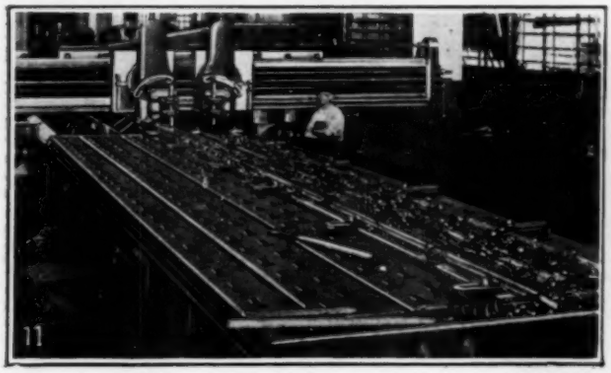


Fig. 5—This cradle and platform were built specially to handle the flues to and from a boiler. When the cradle is filled with flues, it is picked up by the bridge crane overhead and deposited upon the shop track



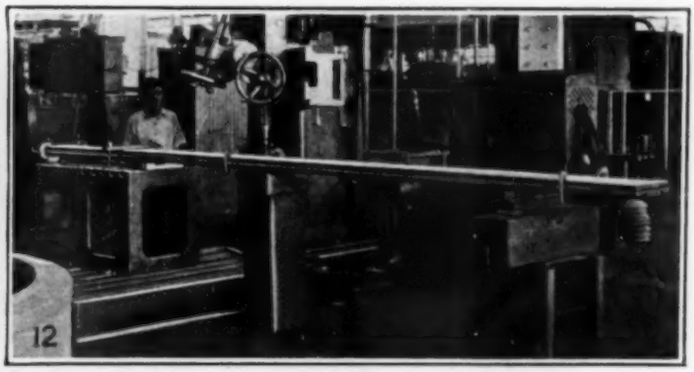


Fig. 11—Planing track rails for replacement strips. Fig. 12—Drilling tracks for wearing strips

Maintenance Work on the Panama Canal Locks

By Fred H. Colvin
Editor, American Machinist

HUGE gate valves are used to control the flow of water in the culverts, Fig. 10 showing one of the gates in position and the other removed for repairs. By remembering that the culvert is 18 ft. in diameter, the size and weight of the valves can be appreciated. And this is only one pair of the many used. The gates are raised or lowered by revolving screws attached to the upper part of the gates. The nuts are of bronze and must, of course, be renewed whenever wear makes it advisable. The gates are held in position by suitable guides or tracks, some of which are plain steel strips, while others are equipped with rollers, depending on their location. And as with the round valves mentioned in a previous article, no provision was originally made for renewing the tracks except by replacing the whole track. Some of the work of making the tracks renewable is shown in Fig. 11 where a large Dietrick & Harvey open-side planer having an extended cross-rail, is planing off the worn surface of two track rails preparatory to putting on faces that can be renewed when necessary, by simply taking off the worn face and putting on a new one. Two hundred tracks were so improved at this overhauling. This planer is part of the very good machine tool equipment to be found in the Balboa shops. The view also shows the louvers or shutters at the side of the shop, which are open except when a storm happens to be blowing in their direction. The louvers make it easy to practically open the whole side of the shop and there is seldom a day when there is not a good breeze blowing through the shop, no matter how hot it may be outside.

After the track rails have been planed they are drilled by a jig or templet, as in Fig. 12, to receive a wearing plate for the rollers. By using the same jig for drilling the wearing plates themselves, they are sure to match. The wearing plates are of nickel steel, experiment having shown it to give the longest life under the conditions of lock use. They are held in place by flat-head screws that fit into counterbored seats in the back of the track. The necessity for replacing a large number of the tracks made it advisable to purchase a large Brown & Sharpe automatic screw machine, all tooled for making the screws for this particular job, and it was still at work on the screws at the time of my visit. There are 124 screws needed on each complete track. The thousands of these screws needed, made it necessary to provide a way of slotting them rapidly, and the fixture shown in Fig. 13 was built for that purpose. The fixture is four sided, each side holding 38 screws at one setting or 152 in all. The screws are in two rows

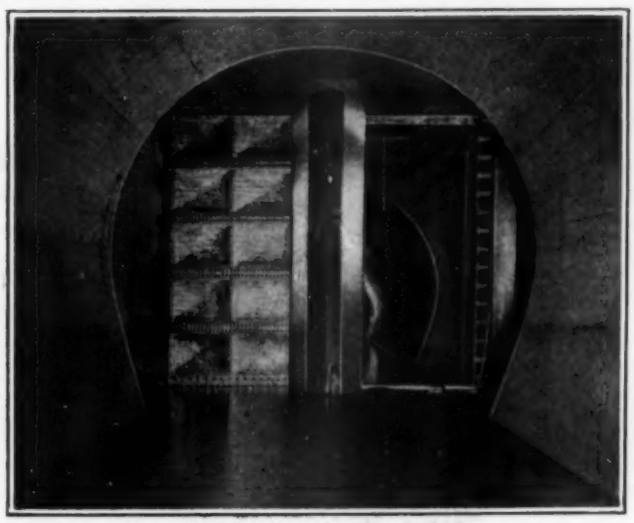


Fig. 10—Gate valve in place in center-wall culvert. One gate is in position and the other one has been removed for repairs. When it is remembered that the culvert is 18 ft. in diameter, the size and weight of the valves can be appreciated

The second and concluding article.

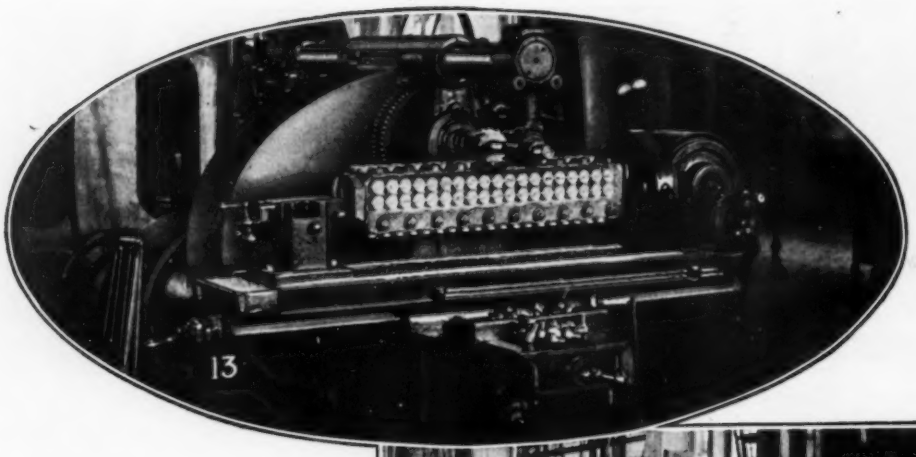


Fig. 13—Fixture for milling screw-head slots. This fixture is four-sided, each side holding 38 screws, or 152 in all. Some of the screws are shown on the knee of the milling machine. The screws are slotted at the rate of 1,200 per 8-hr day

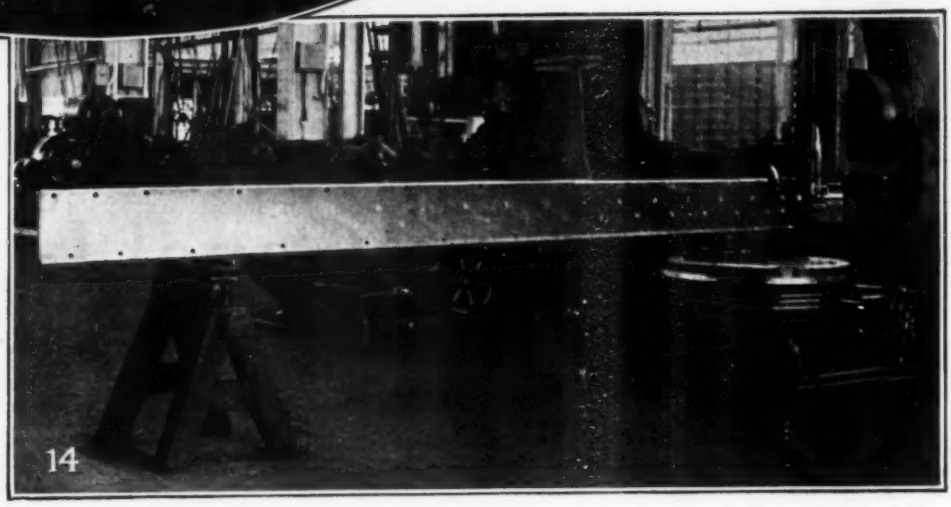


Fig. 14—Squaring ends of track rails. After the renewal strip has been screwed in place, the ends must be squared so as to fit accurately the adjoining track, since it takes several of these units to reach the whole depth of the locks. The squaring is done on a slotter while the track is held against a substantial upright by the large C-clamp shown

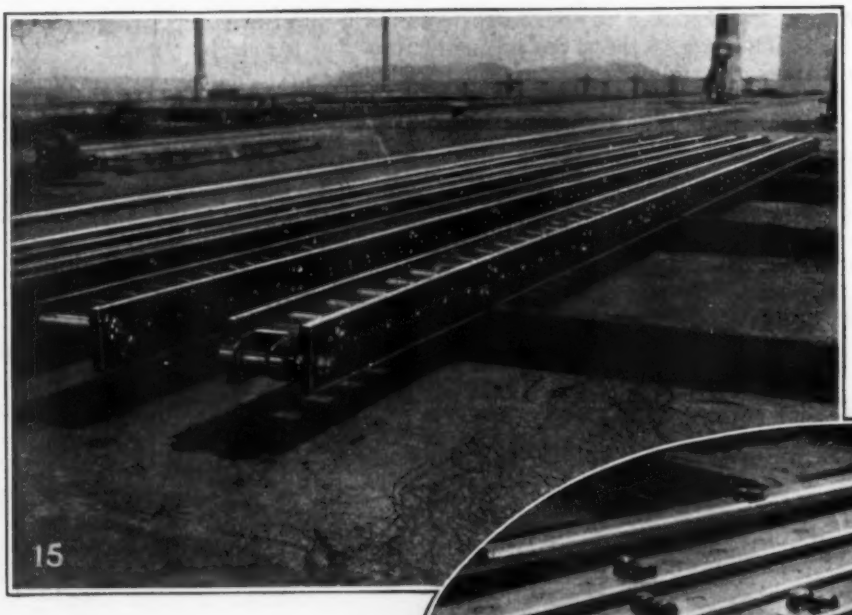


Fig. 15—Rollers placed for inspection. The rollers are interposed between the gate valves and the track and, since they are immersed in water and are also exposed to the air, corrosion becomes quite a problem. The units are composed of side rails held at the proper distance apart by spacing blocks and carry six rollers in each section. The distance blocks are held in position by screw bolts that have the nuts carefully anchored

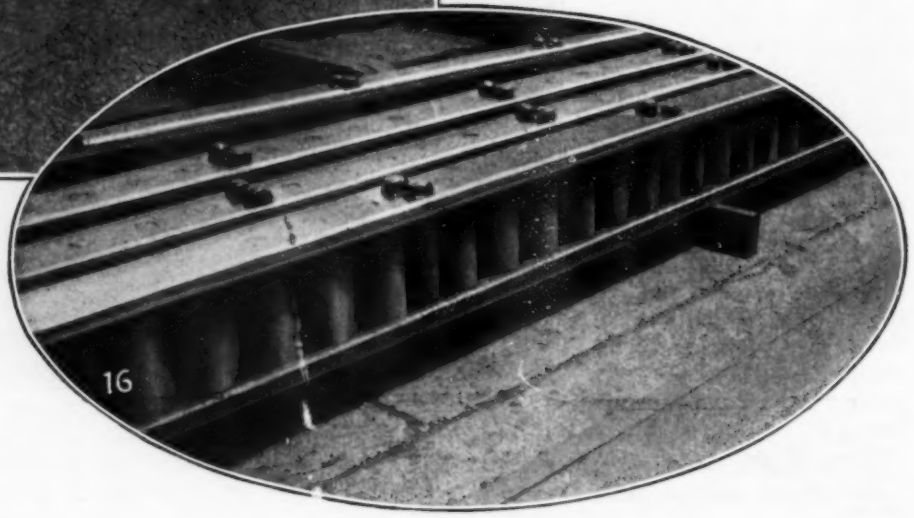
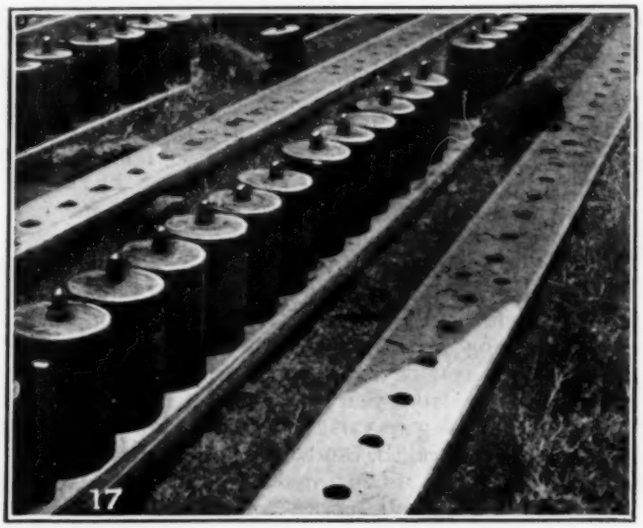


Fig. 16—Close-up of roller track construction. This view shows the construction of the guide rollers and indicates how easy it is for corrosion to prevent their turning freely. It also shows the type of nut lock used on the holding bolts for the distance pieces



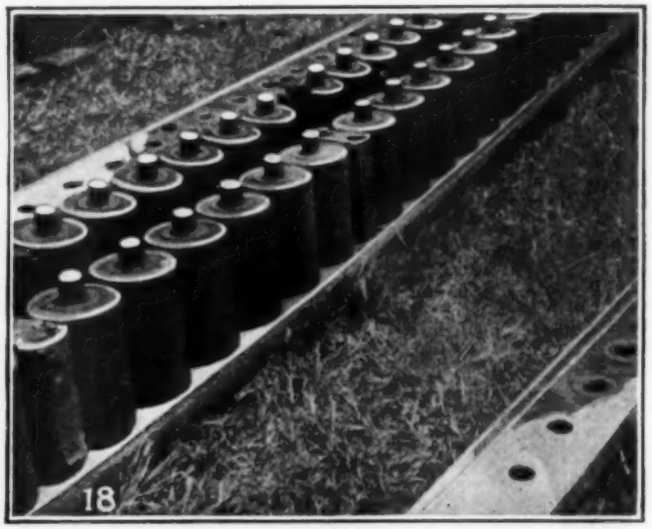


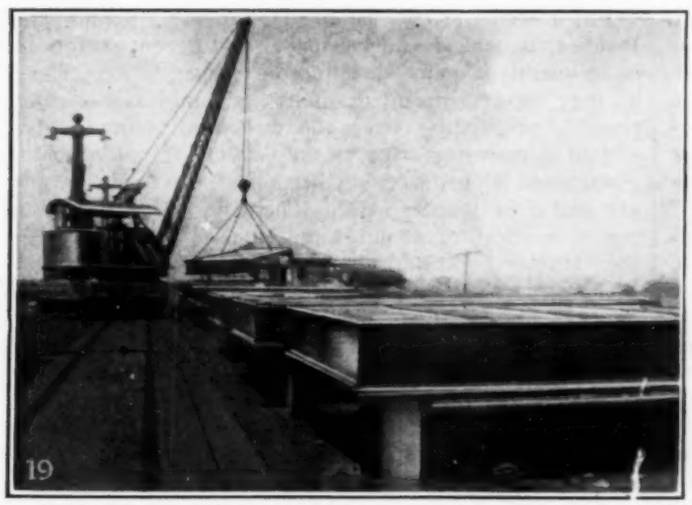
Fig. 17—Rollers and side rails abandoned on account of corrosion. Excessive corrosion is shown on some of the rollers, both on the small ends that form the bearing and on the large diameters of the rollers themselves. In some cases the rollers can be reclaimed by returning when the corrosion is not too deep. The effect of corrosion also shows very plainly on the side rail. Fig. 18—Less corrosion due to difference in construction of bearings. In this case the small ends forming the bearing did not project through the side rail, and there is a marked decrease in the amount of corrosion. Here the surfaces of the rollers are corroded much more than the ends, which is entirely different from the previous case. This is one of the experiments being tried, and it promises to be successful, although there are many problems still to be considered

and by using two slotting cutters, both rows are slotted at one pass, so that 1,200 are slotted in 8 hr. The front of the fixture can be loaded and unloaded while the screws on the upper side are being slotted, making practically a continuous operation and one that is more like production work than would be expected to be found in such a shop as that at Balboa.

After the nickel-steel faces have been screwed on to the roller tracks, the ends are squared as in Fig. 14, utilizing a slotter for the job. The track is leveled and then clamped to an angle plate in order to have the ends square with each other.

One of the problems in connection with the rollers and tracks is that of wear and corrosion, and many experiments have been tried to find ways and means of keeping these destructive forces at a minimum. Some of the rollers can be seen in Fig. 15, mounted in their cages or holders. This view gives some idea of the length of the tracks, and there are many at each lock. The outer bars are held at the proper distance by spacing pieces and there are six rollers between each spacer block. A closer view is given in Fig. 16, which shows the spacer blocks, or distance pieces more clearly, as well as the method of locking the nuts that hold them in place. The nuts are well coated with non-rusting compound, since it must be remembered that these pieces stay under water from three to four years.

Many experiments have been tried to prevent or at least minimize wear and corrosion, and the results of two types of bearings for the rollers can be seen in Figs. 17



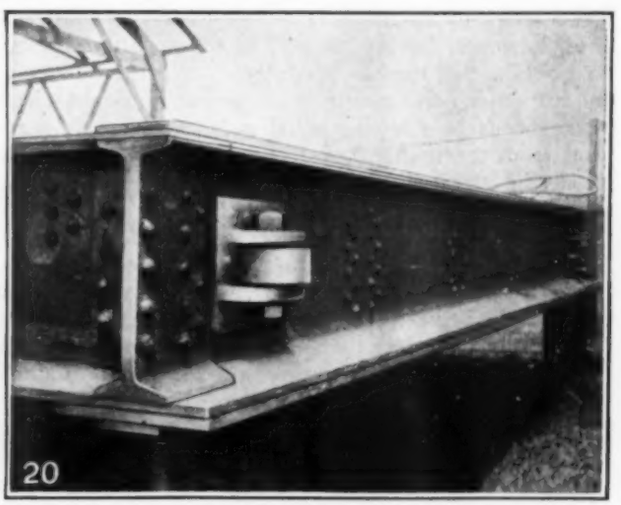


Fig. 19—Gate valves up for inspection. These valves have been taken out of the valve chambers and brought to the top of the locks in order to be carefully inspected, repainted, and to have the type of guides changed. The valves are easily handled by means of the locomotive-type crane shown. Fig. 20—Old-style roller guide on gate valve. This view gives a good idea of the construction of the gate valves, showing how they are built up from deep I-beams, angles and plates. It also shows the type of roller guide formerly used, but which is now being replaced on account of excessive wear and corrosion. The roller has given way to a sliding shoe

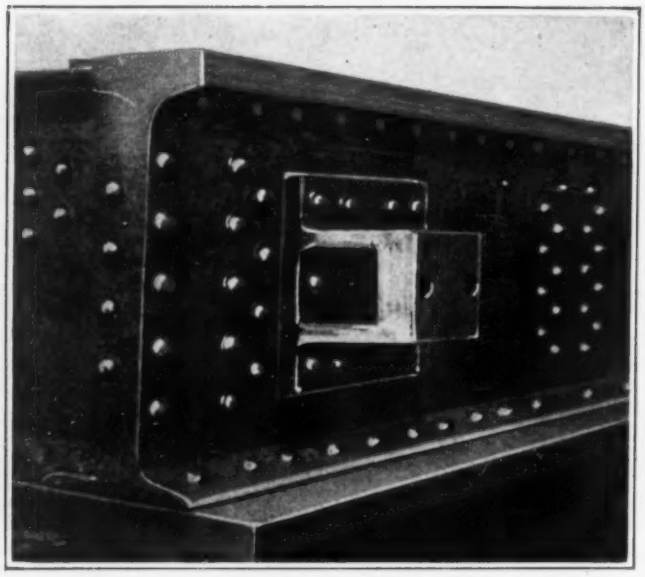


Fig. 21—New type of guide with replaceable bronze shoe. The bronze shoe is fastened to a steel casting that replaces the housing for the roller guide previously shown. The holes are similarly spaced and the rivets are easily driven in the old holes. It is believed that these new shoes will prove much more satisfactory

and 18. In Fig. 17 the small, or bearing end of the roller projects through the side rail as was shown in Figs. 15 and 16. The great amount of wear and corrosion that took place can be readily seen on both the ends of the rollers and on the rails in Fig. 17. In Fig. 18, however, the rollers did not project through the rail but were supported in grease-packed end bearings. The difference is very marked on both the rollers and the rails. The bearing holes are bushed with bronze in some cases, but there is enough electrolytic action in some locations to prevent this being as successful as might otherwise be the case, when used in salt water. Much thought and study is being given to these problems by those responsible for results, and there is a constant improvement in results from year to year.

An idea of the gate valves themselves and the way in which they are handled, can be had in Fig. 19. The gate valves are brought up for inspection and for repainting before being put into service again. These particular gate valves do not slide on the roller tracks but on plain steel ways. As originally built, they were provided with rollers at each end of each side, as in Fig. 20. These rollers gave more or less trouble from corrosion and they are now being replaced with sliding shoes as in Fig. 21. The shoes have cast-steel bases and bronze wearing plates that are readily removable for replacement whenever the gates are taken out.

The Machine Tool Peddler

By Alan A. Wood

THE president of a rather well and favorably known machine tool sales organization is in the habit of making occasional visits at the plant of one of the larger industrial organizations and in response to the young lady greeter's request, he fills out a card somewhat as follows:

Name	John Smith
Position	President
Concern	John Smith Machinery Co.
Business	Peddler

The origin of this habit probably lay in a desire to get a laugh by facetious reference to serious matters. I find, however, buyers as well as sellers often referring to machine tool men as "peddlers." Now, while a "rose by any other name may smell as sweet," I doubt whether the subconscious buying mind gets as favorable a reaction from the thought of a crate of cabbages as it does from the mention of a bunch of long-stemmed American Beauties.

It was my lot to sell engineering equipment of a technical character before attempting machine tools and, in the course of a decade, I never happened to hear the term applied to the technical representatives in any other business but machine tools. The association of the words "machine tool peddler" seems now quite strong and has an affinity somewhat akin to the "damned Yankee" of post-bellum days in the South.

Irrespective of Webster's definition, my recollection of peddlers extends back thirty years to a New England farm. At infrequent and irregular intervals, nondescript and generally untrustworthy specimens stopped at our front door for antiquated and dilapidated rags, bones, bottles, chickens, or "what have you" and gave in return shiny but inferior tinware and a strong alkali concoction called "soft soap." Very little, if any, money changed hands. A bargain was arrived at by barter, there being no fixed price by the seller nor any firm offer by the buyer. Haggling, dickering, lying, and chicanery, were practiced by both sides and regarded as legitimate means toward a justifiable end. As neither expected ever to see the other again, at least until after a very long interval, there was little regard for courtesy, no business ethics; simply a desire to get the better of an immediate, trifling deal in picayune fashion. If either was later dissatisfied with his bargain, he simply regarded himself as "stuck."

But it seems to me that my friend, the Machine Tool Peddler, is, and should be, made of different stuff. He is frequently a man of a quarter century's experience; he may be a technical graduate, certainly a shop man, possibly originating from the design or administrative end of a manufacturing business. He is one who has given most of his working life to an extremely important phase of human activity, namely, the use, maintenance, application, tooling, and sale of machine tools—the "Master Tools of Industry." He represents concerns of employers and millions in capital, who stand back of him. Yet such a man calls himself a peddler!

There are some peddlers in the machine tool business, undeveloped, undernourished bores, who go from door to door inquiring "What are you out to buy today?" But did you ever reflect that the machine business is one of the few large industries which do not support a large group of independent, professional, consulting, designing engineers? You probably know the reason—because machine tool builders employ specialists, engineers, salesmen, to perform these services. These manufacturers get their pay if and when they make a sale. Only a small point in psychology, but what's selling but psychology?

Details of Jigs and Fixtures

Design of Hook Bolts

By J. A. POTTER

Hook bolts are a common requirement of jigs and fixtures—Various kinds of hook bolts, and special features for guiding, binding, and avoiding chips

HOOK bolts are common to both jigs and fixtures, although they are used most frequently on hand and bench milling fixtures. A fixture, if equipped with a hook bolt, properly made and provided with the necessary latches for quick operation, forms one of the best methods of applying the safety-first principle. The operator will use one hand to release the handle or nut for tightening, and to throw the latch and push the hook bolt out, while with the other hand he loads and unloads the work. It is therefore obvious that when the milling machine table is brought back to clear the cutter there will be ample room to load the work. On the other hand, if the work were clamped and tightened on the loading side, the act of tightening would place the operator's wrist or elbow in a dangerous position.

A simple hook bolt is illustrated in Fig. 1. This shows the hook bolt carried through a guide, or hole, and clamping the part *A*. The end of the hook bolt is threaded, and can be tightened by either a nut, handle, or cam, to suit the conditions of the work. The hook bolt should not be used as illustrated if possible to avoid it, since the back, or outer end, is not supported. In a short time the shank will bend and look like the bolt in Fig. 2. Naturally, the bend will prevent the locking action of the bolt, as there will be only a limited movement in which it can slide in the bearing.

The seventh article. The eighth will appear in an early issue.

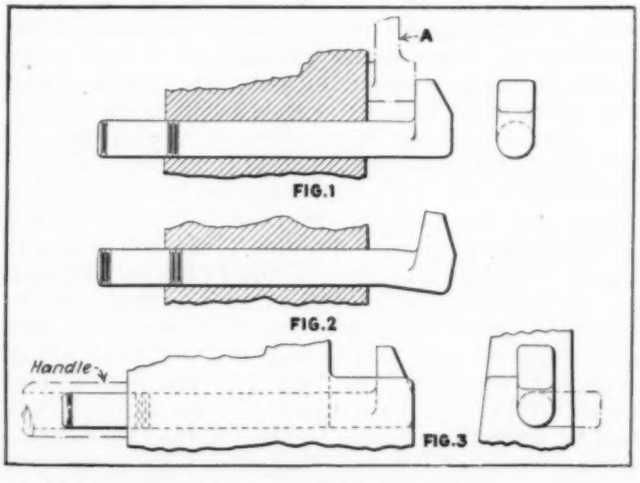


Fig. 1—The simplest type of hook bolt. Fig. 2—Usual failure of this type of bolt. Fig 3—Plain hook bolt supported in the fixture

In Fig. 3 is shown a hook bolt with the outer end rounded the same as the shank, and supported on the end and side. The end support is to eliminate the bend of the shank, and the side support is to provide a stop so that the hook will not turn over too far. The threaded end is usually made a fairly tight fit, so that the act of turning the handle will bring the bolt to its correct position. The hook bolts, Figs. 1, 2, and 3, are usually made by upsetting and bending the end of a rod. Although of cheap construction, they can be used in many places where a more expensive type is not needed.

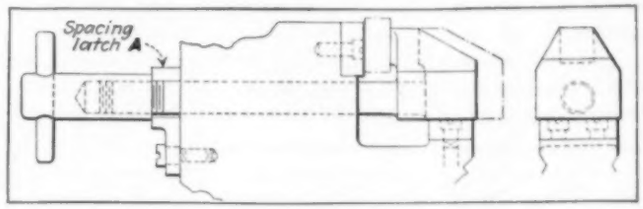


Fig. 4—Complete hook bolt with accessories

A complete hook bolt with accessories is illustrated in Fig. 4. A handle with a pin through it is used for tightening, and the heel or bottom of the hook end rests on a hardened steel block. The rest block is smaller than the flat on the bottom of the bolt. This is made small so that the surface of the block will be always covered by the bolt when it is in either a closed or an open position. In this way the chips from a milling cutter will fall past the block instead of lodging on the surface. A latch *A*, is used as a spacer, which allows the bolt to be pushed forward to the position indicated by the dotted lines, thus allowing room for the loading of the work. This type of bolt is usually hogged out of bar stock, the shank being turned on centers.

A hook bolt with excessive overhang is shown in Fig. 5. This kind of bolt should be avoided if possible, as it is somewhat difficult to make. If necessary to have the overhang, it can be made of two pieces as shown at *A;* or it can be made with a separate shank, as illustrated in Fig. 6, which is still better.

Wider hook bolts are often relieved to bear at two points only. In conditions of this kind, the bottom of the hook end can be either tongued or grooved, to guide the bolt on the seat, which in turn should be doweled to the fixture. This tongued guide is to bring the biting faces up squarely to the work, and is more dependable than to trust to the shank of the bolt for guiding purposes.

This is illustrated in Fig. 7. Wide-end hook bolts can be used to grip on a rough surface by eliminating the tongue or groove on the bottom and elongating the hole through which shank rides, as shown at *A*, Fig. 7. If used in this manner a ball washer or collar should be employed under the handle that tightens the bolt.

A rough surface with a two-point bite will hold much better if the hook bolt is equipped with equalizers. The bolt shown in Fig. 28 has a horizontal equalizer which is located in a slot in the head of the bolt, the screw acting as a retainer only. This type can readily be protected from chips by the use of a sheet-metal guard.

The equalizer hook bolt illustrated in Fig. 9 has the equalizer set in a vertical position, and it swings on the stud, clearance being provided by making the slot deeper. It is not as easily guarded from chips as the bolt shown in Fig. 8, but has more freedom in its action. Hook bolts with large heads should be made in two pieces, as illustrated in Fig. 6. The head is made separate, and the shank is driven in and taper-pinned.

Two or more hook bolts can be tightened in one operation by the use of a shackle, as shown in Fig. 10. If four bolts were to be tightened by this method there would be a shackle for each two hook bolts, and a third shackle to carry the tightening screw. This latter shackle would also pull the first two shackles, so that the whole set would act as equalizers, and bind every bolt evenly.

The bolt shown in Fig. 11 is found on fixtures in which there is not much room, or on those which cannot be operated from the opposite side. The shank is located in a hole, and has a hole through it for a binding screw. A slot is milled in the side of the guide boss to position the hook bolt through the pin when clamping. The boss acts as a backing for the hook end. When the binding screw is released the opening will push the bolt out. The locating pin now being out of the slot, the bolt can be given a quarter turn for loading, and the compression spring will keep the end of the bolt from floating, or getting in the way.

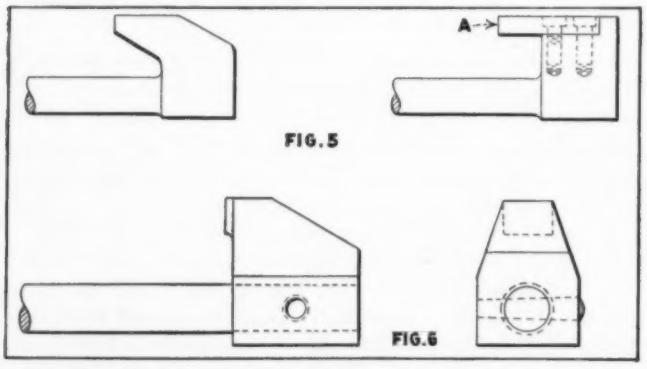
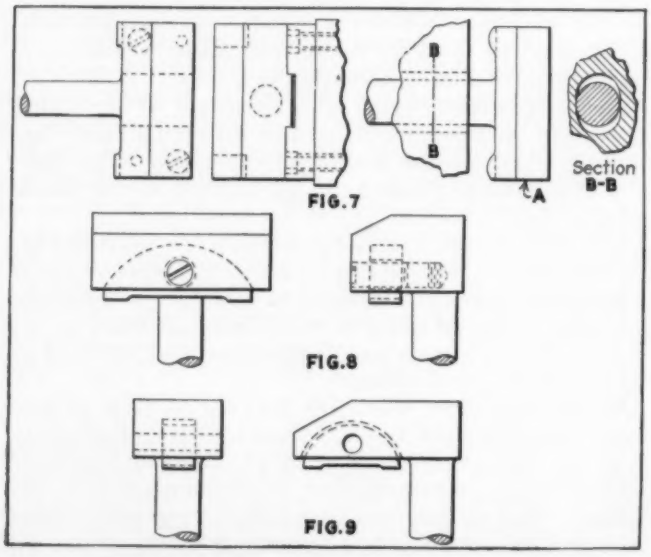


Fig. 5—Hook bolts with overhang. Fig. 6—Bolt made in sections to avoid difficulty in manufacture



Figs. 7, 8, 9—Types of 2-point bearing bolts

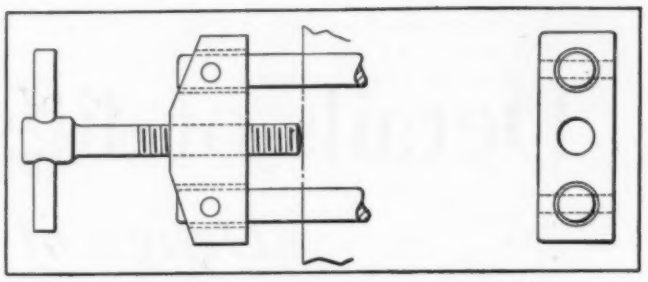


Fig. 10—Shackle for clamping two hook bolts

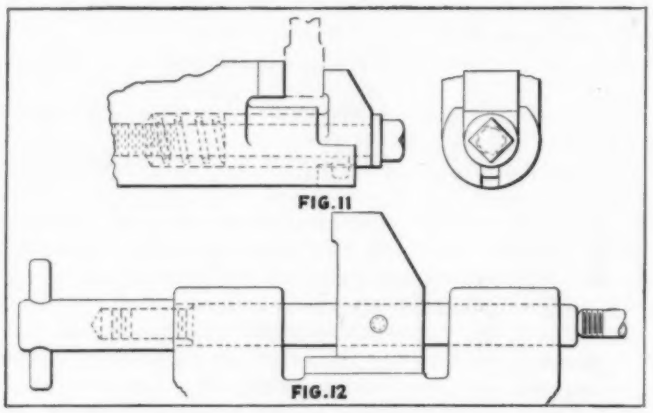
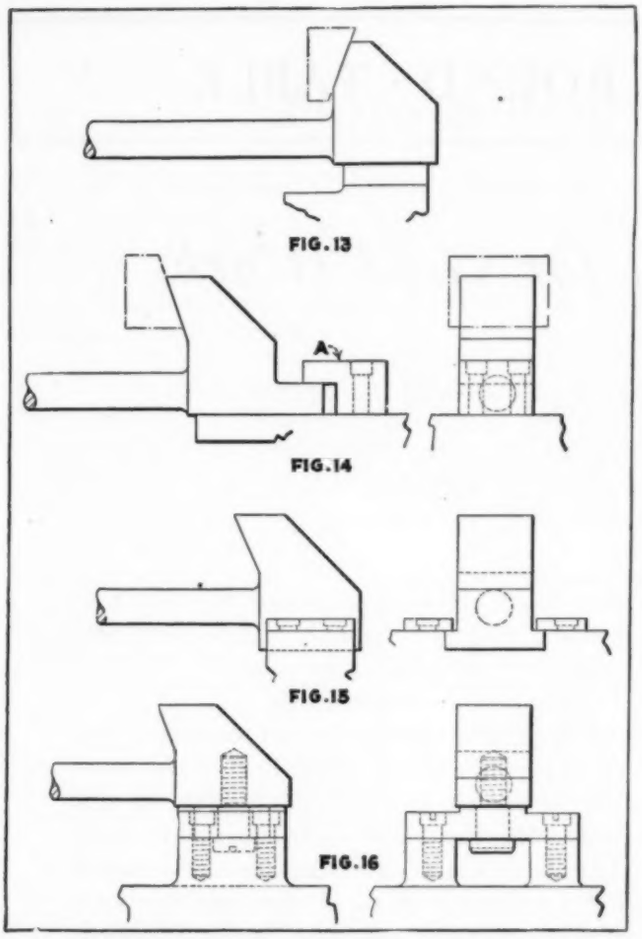


Fig. 11—Hook bolt for close quarters. Fig. 12—Heavy bolt guided on both ends

The hook bolt in heavy-type fixtures is sometimes supported and guided on both sides. It is usually made in two pieces, and held in place by a taper pin, as shown in Fig. 12. This bolt can be tightened from either end by having the threaded end exert a pull by the use of a handle, or by forcing over from the opposite side by a screw, as shown in the illustration.

The head of a hook bolt can be slabbed off on an angle, as in Fig. 13. No particular change has to be made in the design of the bolt, as the pressure of the clamping will keep the hook end down on its seat. Care should be taken, however, to locate the part so that it will not be lifted from its locating points in the fixture.

In Figs. 14, 15, and 16 are shown bolts with the hook end slabbed off at an opposite angle from that of the bolt illustrated in Fig. 13. Tightening the bolt will have a tendency to lift the hook end from the seat, and bend the shank in an opposite direction to the bolt shown in Fig. 2. The bolt illustrated in Fig. 14 has an additional lug on the end, which slides under the block *A*. In Fig. 15 is shown the hook end sliding in a channel, with steel straps on each side to keep the bolt from lifting. Both bolts shown in Figs. 14 and 15 are likely to clog up with chips, but the construction shown in Fig. 16 will be free from chip trouble because of the fact that the seat is covered at all times. The seat is made in the form of a bridge with a slot through it. A shoulder pin is screwed into the bottom of the hook end, and the shank slides through the slot in the bridge. If the block is



Figs. 13-16—Hook bolts slabbed off to suit work. Fig. 16—End of bolt supported to avoid chips

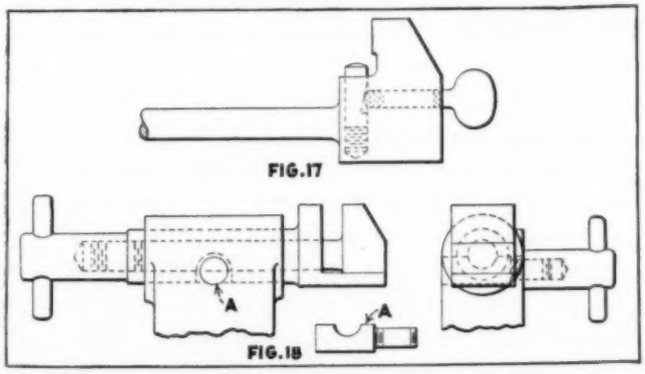


Fig. 17—Hook bolt with supporting pin. Fig. 18—Floating bolt with pin lock

fairly high, chips will not pile up under it, and it can be still further improved by sweating sheet-metal plates on to the supporting lugs.

A hook bolt can be made which will carry a spring pin to be released after the work has been clamped in position. An illustration of this is found in Fig. 17, and is self-explanatory. Hook bolts can be made to float longitudinally, so that they will grip a piece of work and hold it in position without springing. After the bolt is clamped to the work a binding pin, shown at *A*, Fig. 18, can be set, making the whole construction rigid. A full floating bolt can be made on a swivel stud that will slide up and down, using the same construction as in Fig. 18. In this case it is necessary to bind both the hook bolt and the swivel stud after the bolt has been tightened.

Seen and Heard

By John R. Godfrey

Getting paid for development work

ENGINEERING development costs real money. And it usually represents a lot more than the actual time in hours put in on the particular job in question. For back of it lie the years of experience and the losses incurred because some earlier machine didn't pan out right.

Every engineer realizes that there is engineering-development cost on every machine, but few of the big production users seem able to grasp the true inwardness of the shop that builds but a few machines. One engineer expressed the belief that the engineering cost was taken care of in the first machine and that all the rest were easy money.

But the machine builder has a different story.

Instead of charging all the development costs on the first machine, he is induced to put the price low with the idea that, if this machine works well, there will be a large order forthcoming. And he has fond dreams of reaping his profits later. Too often the later orders do not materialize, or the changes required cut out all idea of profits.

It even happens in some cases that the user calls in another builder of machines to bid on succeeding requirements. Having had no development costs, and not being foresighted enough to see that he is hurting the industry and thereby himself, he underbids the designer of the machine and gets the order. Quite frequently he loses money in spite of his apparent advantage, because most machines have at least a few "bugs" that the designer has learned how to overcome. And so everybody loses but the user of the machine.

Those who produce in large quantities do not seem to grasp the problem of the machine builder whose product is definitely limited to a comparatively few machines. The great productivity of the machines he builds frequently limits the greatest possible market to two hundred machines—or less. For, as an industry becomes organized and specialized, as is the automobile industry, the number of builders decrease, and the list of possible customers becomes decidedly limited.

The marvelous decrease in machining costs is an indication of the great amount of ingenuity and experiment that has gone into the building of modern machine tools. But, for various reasons, some of which I have pointed out, remuneration for this development work and the strain on the gray matter, has somehow got lost in the shuffle. Of course, a few have made money—scads of it. But as a whole, there is probably less return per gallon of midnight oil and perspiration than in most other industries.

Some are wondering how long the builders of machines that make much more profit for the user than for themselves, are going to be content with the small end of the bargain. Having shown the world that they are a real industry by the Cleveland Show, "It's about time we quit holding the bag," as one builder put it.

It's going to take some exercise of the old backbone, but it's worth it, for the good of the industry.

THE · FOREMAN'S · ROUND · TABLE

Giving Men Credit for Good Work

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

"WHAT'S got into the super, Al? Patting men on the back, and posting notices telling how good they are, seems to be putting it on a bit thick, doesn't it?"

"Well, I wouldn't put it that way, exactly, Ed. Seems like a pretty good stunt to me. You don't object to having Williams come around and tell you when you do a good job, and you don't exactly feel hurt if somebody happens to overhear him when he does it."

"Quit you're kidding, Al. Of course we all like to have a word of praise once in a while. But I'm not keen about seeing it plastered on the bulletin board."

"Williams isn't doing this just for your special benefit, Ed. He wants to give the men credit for good work, and he wants the other fellow to know it, too."

"But why stick it on the bulletin board?"

"Where else can he put it, Ed? Just between us I'd rather see the bulletin distributed through the shop."

"Give them a good chance to chuck them away easily, eh?"

"Don't you believe it. 'Specially if they're mentioned. Every last man of them will take it home to show the family. And it will help raise their stock at home a lot, too."

"Just how do you mean, Al?"

"Well, Ed, there's a lot of shop men who don't shine at home. They don't come home any too clean, and they don't show up well beside the bank clerk who lives next door. The machinist probably makes more money, but he doesn't shine in the neighborhood. If these fellows can take home a bulletin once in a while with their name mentioned as having done a particularly good job, Mrs. Machinist and the boys will sit up and take notice."

"They'd a lot rather have an extra dollar in the pay envelope, Al."

"I'm not so sure of that. They ought to get all they earn, anyhow, but on top of that any man likes to feel that a good job is recognized by those higher up. And I don't know of any better way of doing it than by bulletins, or a shop paper, issued fairly often. Williams' idea rather strikes my fancy, and I hope he'll carry it to the bulletin distribution stage."

Is the bulletin board the proper place to mention good work? Or should bulletins be distributed to the men, as Al suggests? Will men carry them home to show the family?

All foremen are urged to discuss these questions. Acceptable letters will be paid for. The discussion is not limited to foremen, of course

Discussion of Earlier Topics

Calling Down the "Old Man's" Relatives

RULES posted in the shop should be universal in their application to everyone, whether employee, officer or visitor. If they are safety rules, the danger resultant from a violation is no respecter of persons. The only exceptions should be in the case of an emergency, when judgment rather than rules should govern. For example, the rules may state that no one but the electrician should throw switches on the main panel, but in case of an accident or fire, this may have to be done by whoever is handiest. Officers or visitors must not be permitted to break the rules, because there is also the bad influence on the men. It may be, and probably is, childish, but just let a visitor smoke in a department where it is prohibited, and watch the men all stop and remark about it. If properly approached, the visitor or officer cannot help but respect the sincerity of the man calling attention to the violation, and the men certainly respect and admire a boss who enforces his rules without fear or favor. A watchman cannot be blamed for trying to enforce the rules, because that's what he is hired for. It may be annoying to an executive or his friends, but the only ground on which he can be criticized is in his interpretation of a rule, and the only logical way to correct that is through his superior, and not by arguing with him. After all, you cannot expect a watchman to have the keenly alert mind of an executive. If he did, he wouldn't be a watchman.

—JOHN B. FLOWERS.

Foreman as Inspectors

I AM of the opinion that the foreman who takes a keen interest in the inspection phase of his work is aiding both the organization and himself at a minimum of cost in terms of the price of the final product. This interest may manifest itself in many ways: By checking machine set-ups; by checking the first piece, or bringing it promptly to the inspectors' attention, before the run has progressed far; and by making a "dog" assembly as soon as one each of the component parts are available, or seeing that they are delivered to the assembly department with this end in view. These things will avoid initial errors going unnoticed.

There is the additional factor that if a dispute should arise about the acceptance or rejection of certain parts, the foreman who has personally inspected the part is in a better position to discuss it intelligently when he is called in about it, than if he merely started out on the premise that since Jones is a good man and Jones did the job it should be right. Taken broadly, it makes for better co-operation between the foreman and the inspector, because the foreman learns to appreciate the inspectors' viewpoint, and it is not too altruistic to hope that in time the foreman will regard the inspector as an ally rather than an enemy.

—PHILIP H. HOELZLE.

How Handle the Man Who Can't Listen?

IT HAS been my experience that comparatively few people, unless especially trained, can listen without interruption, and with any degree of concentration, to a given set of directions. But I am not entirely convinced that the responsibility lies altogether on the shoulders of the listener. It would seem that the main points in consideration may be divided into two groups, first, the responsibility of the man talking, and second, the responsibility of the man listening. Brennan's position is often difficult. Seldom, if ever, does he have a complete understanding of the subject-matter to be talked about. He can listen attentively, and follow for a short time, and then some point arises which must be explained to him before he can connect up with what follows. At this point his attention is divided, he is trying to listen and think independently at the same time, with the result that he is able neither to straighten out the point of confusion for himself, nor to follow the speaker. Generally, from this point on, the listener is in a haze, and is unable to concentrate and follow carefully what the speaker is saying. In such cases, it is Ed's responsibility to follow Brennan's line of thought, and to know when to stop and give him time to catch up. In many cases Brennan is of a type who because of lack of training, or because of his own particular makeup, is more or less incapable of following what the other person says. Instinctively and unconsciously he is reaching out, trying to get ahead, trying to see where the talk is leading and reaches the end of the sentence long before the speaker.

—R. B. SMITH.

IN ONE case that came under my observation the man who could not listen was a foreman. The superintendent finally mastered his problem. Whenever he had a suggestion to make, and this foreman would butt in with his objections, interruptions, and discouragements, the superintendent simply would assume a patient attitude, giving full leeway, further encouraging, "Go ahead, Tom; say your say, but after you get through, I'm going to talk! I'm listening now; you listen later!" The scheme worked, and Tom was completely cured.

—FRANK V. FAULHABER.

THE · NEXT · TOPIC

Should the Super Talk to the Men?

ADVANCE QUESTIONS

Williams has begun to make personal contact with some of the best men in each department. Ed resents it as a reflection on him and his work. Al thinks it has good points. Who is correct?

Ideas from Practical Men

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from a minimum of five dollars upwards, depending upon their merit

Dimensioning Drawings—*Discussion*

By B. R. Sheets

In John F. Hardecker's article under the title given above, on page 703, Vol. 67, of the *American Machinist*, he shows the fallacy of the duolateral system. However, it is apparent from his writing of $(3.000 \pm \frac{002)}{000)}$ that he prefers the drawing to read so. Is it not better to write the unilateral system (3.000 + 0.002), for the following reasons?

Consider how the man reads this dimension when measuring the work. Let us say it is an outside diameter and the workman is using a pair of micrometers. It is much easier to read one, two or three thousandths above or below the 3.000 in. than to make a subtraction, mental or otherwise, to get his limit, and then have to translate the reading of his measuring tool, whether he may be using micrometer, vernier or other type of instrument.

Limits are of little or no value unless interchangeability is desired, and in that case there will be enough production to warrant gages, which will eliminate the necessity for the workman to know the dimension.

To the writer's mind, the unilateral is the ideal system, and the fewer figures used to express it the better. It goes without saying that the mechanical drawing is the language of the mechanic, let us keep his language as clear, simple and concise as possible.

Embossing and Trimming Dies for Escutcheons

By John J. Kauffman

The number of operations that go to the making of embossed escutcheons varies according to the difficulty of embossing, the elaborateness of the design, and to some extent with the quantity to be produced. The plain beveled escutcheon is produced in great numbers, and to make it the dies shown in the accompanying drawings are used. Two operations are required.

The first operation is embossing, which includes countersinking the screw holes and cutting the piece from the strip of stock. A 200-ton press of the toggle type is used to make the smaller sizes (7 in. long and under) while presses up to 600 tons may be employed to make the larger ones.

Because of difficulties connected with the hardening of solid dies sectional dies have been evolved for the work. Though expensive in the matter of first cost they soon justify themselves by reason of their low cost

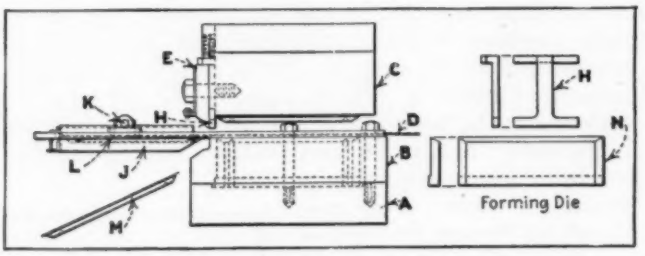


Fig. 1—The die with which plain escutcheons are embossed

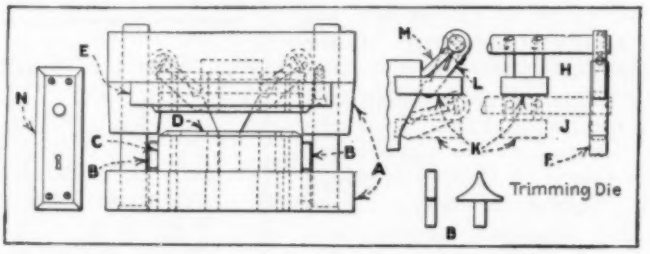


Fig. 2—The trimming die and its attached mechanisms

of maintenance and the quantity and quality of work they will turn out.

The sectional die has a hardened base to support it, and is composed of a solid outer rectangle into which four narrow pieces are fitted. These pieces are made with beveled upper surfaces, ground all over and fitted together accurately at the corners. A solid centerpiece fills the space inside the smaller rectangle formed by the pieces above mentioned. Four plugs in this part, one at each corner, form the countersinks in the escutcheon for the screw heads. The punch is solid and is fitted to gages, so that all punches of a given size are interchangeable.

An advantage of this type of die is that the tiny seams between the sections provide an outlet for the oil with which the stock is coated. This oil makes trouble in solid dies by collecting in the impression and preventing the corners of the work from coming up sharp.

The second press operation consists of trimming off the outside flanges and piercing the six holes. It is performed on a standard 20-ton press. The die is of the compound type and is mounted in a pillar press with the punch below and the die above. A beveled plate which fits the work is fastened to the top of the punch for the purpose of locating the work properly.

The die is fitted with a shedder, or knock-out, the action of which is positive and operates to eject the work only when the press-ram nears the top of its stroke. The operator by thrusting a small wooden paddle under the die as it rises is enabled to catch the work as it falls and thus prevent it from being marred. At each end of the punch is located a cutter to cut the scrap in half and to

cam it away from the punch, from whence it must be removed from time to time by the operator.

The foregoing relates only to plain escutcheons, the ornamental variety being much more difficult to produce. Dies for the latter are almost always made solid. To make these escutcheons the stock is cut to the right length from the strip and is placed individually in the embossing die. Several successive operations may be necessary to do the embossing, the number depending upon the elaborateness of the design. Trimming is always a separate operation, as is also the piercing and usually the countersinking of the screw holes.

Of the sketches herewith Fig. 1 shows the forming and Fig. 2 the trimming die. In Fig. 1 *A* indicates the hardened die base, *B* the upper half of the die with sections in place, *C* the solid punch with cutting-off mechanism attached, *D* the stock, *E* the cutter, and *H* the knock-off which keeps the stock from feeding past the cutter. A stop-box *J*, swinging on trunnion *K*, receives the formed escutcheon *L* when cut off. The embossed escutcheon is shown at *M*, and at *N* is one of the pieces of which the embossing die is composed.

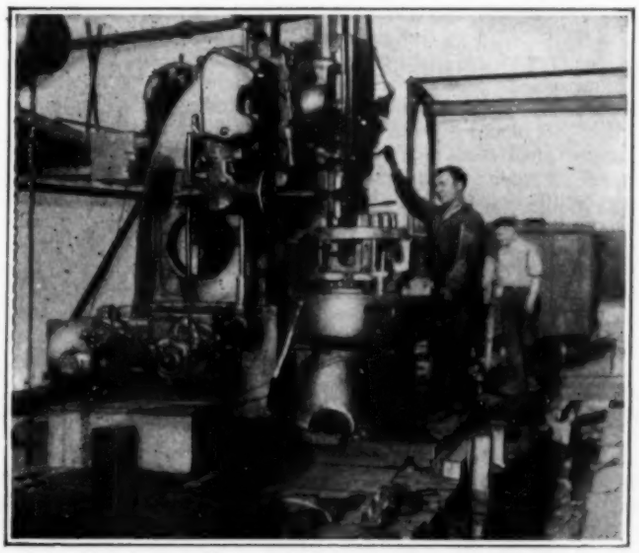
In the trimming die, Fig. 2, *A* indicates the parts of the pillar press, *B* the scrap cutter, *C* the punch with locating plate *D* attached, and *E* the trimming die, showing the knock-out mechanism. An end view of the knock-out mechanism may be seen at *H* in the position occupied by it at the top of the stroke, while *J* indicates the position of the same mechanism at the bottom of the stroke.

The shedder is shown at *K*, in both end and side views and in upper and lower positions. Cam lever *L* and shedder lever *M* are the parts that actuate the shedder. At *N* is a finished escutcheon.

Running a Machine on a Flat Car to Reduce Time Lost in Moving

By Frank C. Hudson

Moving a plant from one location to another usually entails considerable loss of time. The illustration shows a case where the loss (outside of loading and unloading the machine) was reduced to 45 min., the actual time required to shift the car from one shop to the other. It happened during the moving of the Breckenridge Machine Company, of Cleveland, from its old quarters in the city to its new plant in the outskirts. It also shows one of the advantages of motor-driven machines.



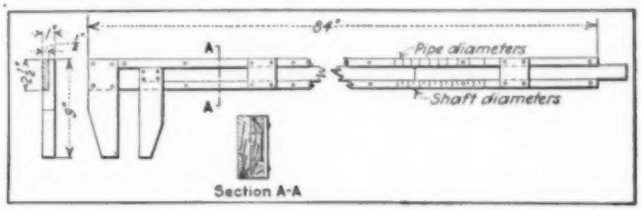
Running a boring mill on a flat car

In order to maintain production on an important job that called for quick delivery, wires were run to the boring-machine motor as soon as the car arrived at the new plant. The operator was enabled to keep the machine running while all the other machines were being unloaded from the car, and so keep his production schedule nearly at normal. By this means there was little loss of time and the customer was pleased at the effort made to maintain delivery on his work.

A Handy Sliding-Jaw Caliper

By Daniel D. Eyster

The illustration shows a sliding-jaw caliper that proved to be a useful tool for the engineer of a plant layout. It was used in taking measurements of all existing pipes, shafts, sub-structure beams, etc., that were located near the ceiling or roof and were out of easy reach.



A large sliding-jaw caliper

The tool is made entirely of hardwood and nails. It can be made with sufficient length of slide and jaws to measure the largest diameter required.

Smoothing Patterns With a File

By Donald A. Hampson

In the matter of smoothing off patterns that have had the grain raised by coatings of shellac, more care is necessary than is required upon other wood products that have been similarly roughened. The matter of dulled edges and roughed corners is not serious on the average wood product. but such action upon the carefully-made pattern may change the whole thing into a slovenly job that cannot be expected to produce castings true to the desired form.

A file is a valued smoothing medium, once its worth is known. Roughened surfaces may be smoothed as readily and as quickly with a file as with a sandpaper block. The file has the advantage of being rigid, not flimsy like the sandpaper over a block, or the loose piece of sandpaper held in the hand. Thus it is possible to smooth clear to the edge of a piece of wood without rounding over the corner. A file will do what sandpaper will not when it comes to inner angles, and that is to finish them right out to a sharp corner.

Patternmakers can upgrade certain classes of work very easily by adopting the file instead of sandpaper for smoothing. Wood is relatively so soft that the elasticity and sponginess of sanding mediums often take away the accuracy and finish attained by nice machine work. The fine-toothed file, or a file that has lost its original sharpness, will do the work admirably.

Technical Abstracts

Recent Experiments Relating to the Wear of Plug Gages

The testing machine provides for the repeated lowering and raising (equivalent to insertion and removal) of the gages from split rings representing the "work"; contact pressure, presence of non-metallic abrasives and other important variables are under control.

The principal conclusions to be drawn from the described tests in gaging file-hard high-carbon steel, a heat-treated and aged aluminum alloy and a cast iron containing appreciable proportions of pearlite are:

1. Metals which show superior resistance to wear when used in one metal do not necessarily show superiority when used in another metal.

2. Of the numerous metals and treatments studied, chromium-plated gages showed the best resistance to wear in the metal-to-metal wear tests under consideration. The ammonia-treated chromium-aluminum steel, called Nitralloy, was second in order of wear resistance. These two metals were much superior to the remainder of the group, which showed variations but no radical differences in wearing properties.

3. File-soft gages made from high-carbon steel were generally superior in wear resistance to gages made of corresponding steels in the file-hard condition. However, the file-hard steel gages were not as badly scratched after test as the file-soft gages.

4. Gages made from Stellite, from a high-carbon, high-chromium iron alloy and from hardened high-speed steel were found to have fewer scratches than the gages made from file-hard or file-soft ball race, 1.05 per cent carbon and oil-hardening tool steels or chromium-plated gages. The last named consistently showed much the highest resistance to wear, but were found to be badly scratched after test. However, this was ascribed to the conditions of service which permitted particles of the brittle chromium, torn from the electro deposit, to become imbedded in the relatively softer metal with which the chromium plate was in contact. Due to the high hardness of chromium these imbedded particles were able to score the plate. The Nitralloy gages were not scratched, but appeared to be pitted; this was ascribed to the brittleness of the nitride case which permitted particles to be torn from the surface of the gages.

5. As the conditions of gaging became more severe, either through a change in the metal gaged or by the introduction of a non-metallic abrasive, differences in wear resistance of the different gage metals became less marked. In the abrasive wear tests Stellite showed the best wear resistance while the chromium-plated gages and the high-carbon high-chromium alloy gages were next in line.

6. In gaging the file-hard high-carbon steel (without abrasives) dark areas frequently appeared on the surfaces of the gages; these were presumed to be iron oxide. In gaging wrought brass containing about 70 per cent copper and 30 per cent zinc, copper-colored or brass-colored deposits were observed on the gages which made it impracticable to study wear resistance of the different metals. This applied to tests made dry or in the presence of various liquids such as water, alcohol, sodium bicarbonate solutions, etc. When this brass was replaced by a cast copper-tin-lead alloy, no such coatings were observed.—H. J. French and H. K. Herschman, *Transactions of American Society for Steel Treating*, December.

Manufacture of Seamless Tubing

For making seamless steel tubing up to 9 in. in diameter a special process known as the piercing process is used. This makes use of the principle that a solid, hot round bar, or billet, when rapidly revolved and passed forward through a pair of rolls of proper design and set at an angle to each other, tends to open a hole in the center of the piece, which gradually works clear through the length of the piece as it passes through the rolls. A mandrel, or plug, with a pointed nose and shaped somewhat like a projectile, tapered at the proper angle, and known as the "piercer," is attached to a water-cooled rod and is inserted between the rolls from the delivery side so that its point just passes the line where the two rolls cross.—*Iron and Steel World*, September.

Guarding the Health of Employees

Health work for the benefit of employees of large industrial plants and offices is as much a part of routine management as inspection of machinery. The owners of many small factories, however, are still unable to eestablish a satisfactory health service for their employees because physicians, nurses, hospital beds and clinic equipment are too costly.

To such establishments the increasing attention given to industrial health by volunteer health agencies is a boon. These agencies are prepared to co-operate with employers. One such association has organized local factories into units for co-operative medical service. Each plant in the unit provides a first-aid or clinic room in its own establishment and pays a quarterly pro-rata share of the maintenance of the unit, based on the number of employees.—*Iron Age*, December 8.

When Germany Pays in Kind

The payment by Germany of reparations "in kind" under the Dawes Plan is sure to have an effect on American trade. During the reparations year ended August 31, 1927, the value of such goods reached $154,000,000. Under the "miscellaneous" classification were 800 machinery shipments to France valued at over $8,000,000 and this was only a small proportion.

With the present arrangement payments in kind are effected under contract between German firms and those in the former allied countries. The amounts and character of these contracts are passed upon by the Reparations Commission in collaboration with the Transfer Committee. The goods move forward like any other export shipments and are not segregated from ordinary consignments.

Cartels allocating markets and establishing prices are functioning in the fields of raw steel, rails, cast-iron tubes, aluminum, glue, enamel ware, rayon, electric bulbs, plate glass, bottles and potash. Some are directly under government patronage, others operate through strong investment controls.

The casual observer might ordinarily be inclined to brush all this aside with the statement that, after all, this is of interest only to exporters whose operations are confined to a small list of major items, and that our entire export total comprises perhaps only 10 per cent of our total commerce, with the remaining 90 per cent confined within our borders.

But 10 per cent is all too frequently just enough to spell disaster (if it is "in the red"), as many firms have sadly learned. Furthermore, our export trade, which will probably reach five billions in 1927, comprises according to official statistics, no less than 1,180 different commodities and countless subclasses and grades. It is no longer made up of self-selling raw materials and patented specialties—sewing machines, cash registers, typewriters, automobiles, and so on—in the hands of a few large companies.

No less than 56 per cent of our total overseas' sales are made up of wholly or partly manufactured wares (and this does not include manufactured foodstuffs such as flour, canned goods, and breakfast cereals) as compared with 35 per cent during 1901-1905.

With such a large and steadily increasing stake in foreign markets, with domestic price levels and output curves more sensitive than ever to major developments throughout the world, there is an obvious need for a wider interest in such international factors as cartels and reparation payments.—Julius Klein in *The Magazine of Business*, December.

Characteristics of Molding Compounds

The Phenol Resins

The phenol resins form a group of compounds that have come into wide use in the mechanical industries. They are used to replace metal castings and sheet metal for a great variety of parts such as handles, panels, thumb nuts, silent gears, and radio and electrical parts. They are also excellent substitutes for the more expensive hard rubber for many parts, and are substituted for wood for such uses as tool handles, automobile steering wheels, and airplane propellers. They can be die-molded in thin sections, which makes them suitable as substitutes for brass and steel for intricate sheet-metal parts that would be difficult and expensive to draw. Meter covers, clock cases, and similar parts that were formerly made of sheet metal or cast iron are now often molded of these compounds.

The phenol resins are reaction condensation products of phenol (carbolic acid) and formaldehyde. Although resinous in appearance, they are not easily fusible and soluble like natural resins. They are unaffected by oils, and almost impervious to water. They also possess unusual hardness and tensile strength, greater than that of amber, which is one of the hardest and strongest of the natural resins. They do not have the elasticity of rubber or celluloid, which gives them an advantage for mechanical parts, since it permits of more accurate molding and machining. They also withstand greater rises in temperature than natural resins, and have high insulating value.

Various Colors Obtainable

The phenol resins in the primary natural state are amber colored, or under certain conditions may be made colorless. Any desired color can be obtained by incorporating in the process suitable dyes or pigments. The synthetic resins in this condition are marketed chiefly in the form of rods, sheets, and tubes. The molding materials consist of the phenol resin intimately mixed with a proportion of fibrous filler such as wood flour or asbestos, and also usually with paraformaldehyde or some other chemically active substance. They are then generally marketed in the form of powders or plastic sheet. In molding, the powder softens under the influence of heat in the dies, and at a pressure of about 2,000 lb. per sq.in. will flow into almost any intricate form. Further application of heat at approximately 350 deg. F., while still under pressure, hardens the material so that it may be removed from the mold without waiting for cooling.

The fibrous material incorporated in the resin gives the finished article greater resistance to shock, and still allows facility in molding. The accuracy of the molded article depends only upon the accuracy of the mold, or die, since the plastic material will follow the most intricate workings and produce clean-cut edges. A highly polished mold gives a highly polished piece that does not require subsequent polishing. The "fins" can also be kept to minimum thicknesses, and are more easily removed than metal fins from castings. Metal inserts may be firmly imbedded in the molding material with such accuracy as to eliminate necessity for machining lugs, drilling and tapping holes, or assembling various separate units. The resins may also be molded over or around wooden or metal cores where extreme strength and rigidity are required in the finished part. The greatest value of the phenol resins is in molding or forming to finished sizes since they do not machine easily. Molding materials for special purposes are made by putting in fillers with the desired characteristics. For example, graphite is employed as a filler where a self-lubricating material is required.

Physical Properties

The tensile strength of phenol resins varies from 3,500 to 7,000 lb. per sq.in., which is about the same as that of hard rubber. In laminated form the tensile strength may be as high as 45,000 lb. per sq.in., and it is in this form that it is used for gears. These synthetic resins do not deteriorate with age as does hard rubber, and will withstand continuously temperatures up to 300 deg. F., whereas hard rubber softens at 150 deg. F., and will not stand up against any heat contact with hot water or steam. The specific gravity of the phenol resins is about 1.35. They do not shrink or expand, and likewise do not "cold flow."

Phenol resins are also used in solution form, "varnishes," for coating and impregnating paper or cloth. These sheets are then submitted to heat and pressure and made into plates. These laminated plates are strong and tough, and are made up in any desired thicknesses. Laminated impregnated paper is sometimes also made up in the form of rods and tubes. Cotton fabric of various weaves and weights is used for the laminated phenol resin products. For silent gears the impregnated canvas may be made up solid and the gear cut out, or the gears may be molded from layers of the canvas. Laminated phenol resins have also been employed for ball-bearing retaining rings.

The usual commercial colors of the phenol resins are black and reddish-brown, but other colors can be obtained from the makers of the raw material, and also blending and mottling can be done by the molders. While the molding is chiefly a mechanical process that can be done in any plant equipped with suitable presses, the manufacture of the molding material is a highly specialized chemical operation. The molding materials are marketed under various trade names such as Bakelite and Durez. Other trade names such as Celeron, Formica, Micarta, and Fibroc are used to designate laminated phenol resin products.

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American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

Established 1877

The Merchant Marine Problem

APPARENTLY there is general agreement in the United States that there should be an American merchant marine and that it should be owned and operated by private enterprise, but no one has been successful as yet in divorcing the government and the shipping business. Various proposals to accomplish this end have been put forth but none has been as promising as that of Edward N. Hurley, war-time head of the United States Shipping Board.

Mr. Hurley suggests, among other things, the establishment of a revolving fund of half a billion dollars to be loaned to private interests at two and one half per cent for the building of freight and passenger ships, and the purchase by beneficiaries of the fund of ships now in the possession of the Shipping Board. The plan seems sound enough to merit active support provided it does not lead to the construction of more slow, relatively inefficient boats of the type built during the stress of war conditions.

Judging from the experience of equipment builders, however, the Wilder plan of building thirty-five-knot, four-day express steamers seems much more likely to enable America to regain maritime supremacy. In other words, the duplication of an existing service seldom leads to conspicuous success in any field of endeavor, while the provision of something new and better spells progress. We have more slow freighters now than we know what to do with, but superior service for freight or passengers is inadequate.

The 1927 Census Is Up to You

SUCCESSFUL business managers today know the value of reliable statistics, and of statistics that are up to date. It is, therefore, no easy task that the United States Bureau of the Census faces in undertaking the biennial census of manufactures that is to serve American industry as one of the important economical tools in gaging conditions, and the fullest co-operation of manufacturers is asked in this important work.

Present requirements of industry have demanded a census every two years instead of the five-year census in force previous to 1919. This also means that the time element in collecting and tabulating the data is of greater relative importance. No work of tabulation by the Bureau can be done, however, until manufacturers do their part in filling out the data sheets and sending them in. The Census Bureau announces that it is ready this year to make every effort to have the summary figures available in a shorter time than ever before, but it needs the co-operation of all manufacturers to this end. If the greatest economic value of the census is to be realized, therefore, manufacturers should make as early reports to the Bureau as possible on their 1927 operations.

Depreciation or Replacement Values

DEPRECIATION is a much disputed point in many industries. Even if confined to the decreased earning power resulting from wear alone it is far greater than in years gone by. When coupled with obsolescence, occasioned by the development of newer and better machines it becomes a major factor in modern management.

Practice varies from charging off no depreciation—under the illusion that repairs keep a machine as good as new—to charging off all costs at the end of the first year. The first is unfair to the user, the latter demands a 100 per cent investment from the builder.

If, instead of using the term depreciation, which is interpreted in so many different ways, we use a new term, it might be easier to consider modern conditions as they really exist. In order to help put aside the old traditions it has been suggested that we use the term "replacement" cost or fund in place of depreciation. In other words, consider the necessity of being able to replace the productive capacity of our equipment under present day prices and conditions.

With the rapid advances being made in the productive capacity of machines, however, the average manager is not content merely to replace his productive capacity but desires to increase it. If the new and more highly productive machine is priced higher than the old machine, as is likely he can hardly expect his replacement fund to cover the entire cost. The additional cost becomes added investment in the plant according to this method and it is this portion of the cost that should be considered in calculating amortization in as short a period as possible.

It is the successful solution of problems of this kind that make the modern manager worth much more than his predecessor of a decade ago.

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Landis Automatic Bolt Forming and Threading Machine

EMBODYING features that insure rapid production, accuracy of product, speed of set-up, and safety of equipment, the Landis automatic forming and threading machine has recently been placed on the market. This machine is the product of the Landis Machine Company, of Waynesboro, Pa. Its capacity is for bolts $\frac{5}{16}$ to $\frac{3}{4}$ in. in diameter, 1 to 6 in. long under the head, and with $2\frac{1}{2}$-in. maximum length of thread. It is shown in Figs. 1 and 2. The bolts are automatically fed from a hopper, conveyed to the grips at the loading station, indexed to the pointing station, then to the threading station and back to the loading station, where they drop from the grips into a bolt-collecting compartment. The operations of equalizing, or cutting to length, and threading are automatic.

Among the features of design are:

Constant time element for the withdrawal of the forming and threading heads, and indexing of the turret chuck, irrespective of the diameter, pitch, and length of thread, the threading speed, and the quality of the material.

An accelerated motion for the withdrawal of the forming and threading spindles and the indexing of the turret.

Oscillation of grip jaws, in opening and closing, about a pivot parallel to the bolt.

A single set of cams covering the entire range of the machine.

Speed of threading head controlled by change gears.

Automatic safety devices.

Turret chuck, with operating mechanism, Geneva indexing movement, and lock bolt forming a self-contained unit.

Delivery of finished bolts and chips to separate compartments.

As shown in Fig. 2, a view of the working side of the machine, the turret chuck has three stations, one for loading and unloading the bolts; one for cutting to length and forming the end of the bolt; and one for threading. These operations are performed simultaneously. The same illustration shows the method of applying the motor in the ventilated base of the machine. Power is transmitted to the main driving shaft by means of a short belt. The machine can also be furnished with single-pulley drive. In either case, a rotary geared pump, supplied from a reservoir in the base of the bed, and driven by belt from a pulley on the main drive shaft, pumps the coolant to the chasers in two streams, one through the threading spindle, the other through a nozzle, and to the forming tool in a single stream through the forming spindle. Fig. 2 shows, also, in conjunction with Fig. 3, the "Landex" die-head, which is of the revolving, pull-off type and of $\frac{3}{4}$-in. capacity.

In order to secure full thread at the start, accurate lead, and minimum taper the design incorporates an arrangement through which, by a system of compound springs, the control of pressure as the die takes hold of the bolt is made the equivalent of the hand control exercised by the skilled operator on a hand-fed machine. The threading unit is counterbalanced to secure uniform and constantly con-

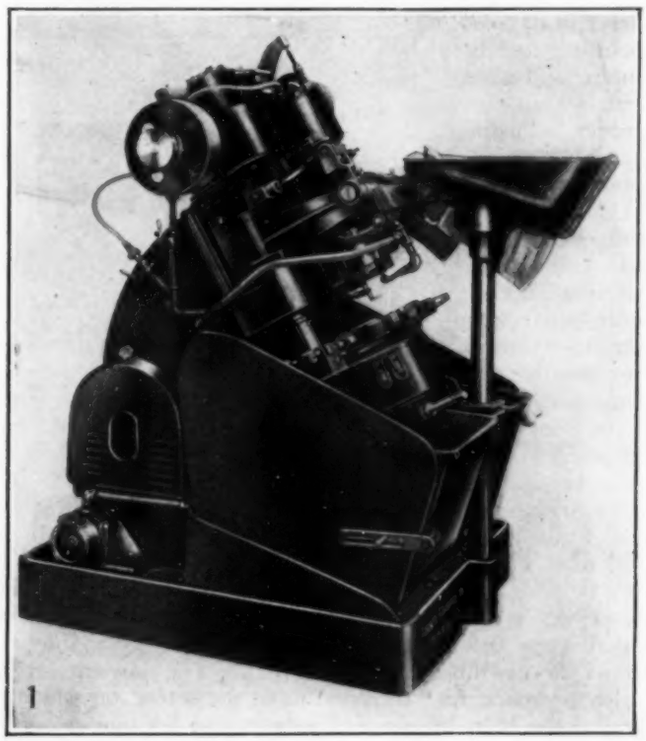

Fig. 1—Left side of the Landis Automatic Bolt Forming and Threading Machine. Fig. 2—The working side of the machine

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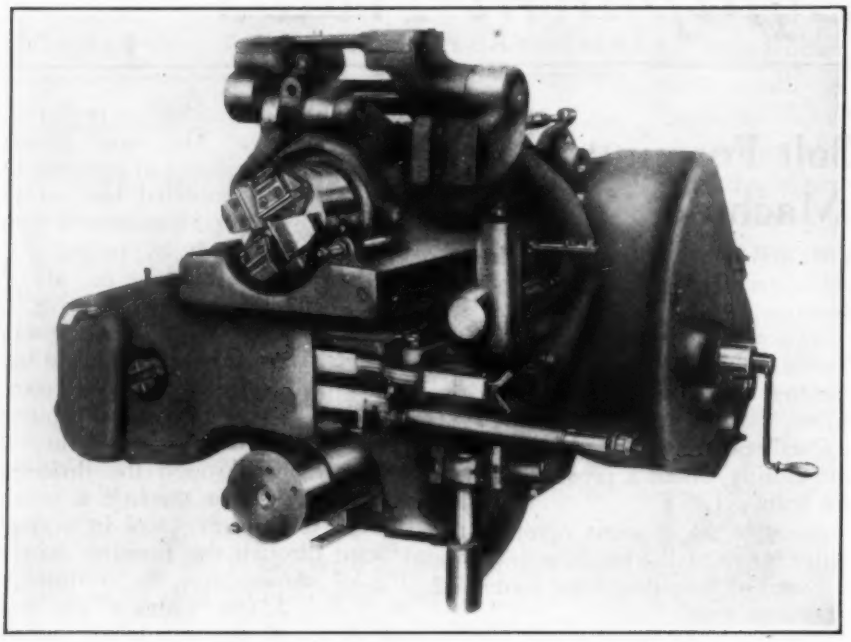


Fig. 3—Close-up view of the spindles and slides, looking upward

trolled advance of the diehead on the bolt.

Speed of adjustment over the capacity range of the machine has been achieved. The builder gives 10 minutes as the time required for changing for length of thread and length of bolt; 55 minutes for change in diameter, pitch, length of thread, and length of bolt; 2 minutes for change of speed of the threading head. These rapid changes are due to the use of a single set of cams covering the size range of the machine, in connection with which no re-timing or adjustment is necessary. They are due, also, to the fact that the speed of the threading head is changed by means of pick-off gears; that a change in the speed of the threading spindle causes a corresponding change in the speed of the forming spindle; and that the high speed of the indexing mechanism is constant. With a given set of change gears the threading and forming spindles revolve at constant speed. Mounted on the shaft that drives the cam are two gears which, by means of tooth-clutches, drive this shaft at different speeds. These clutches are automatically operated to drive the shaft at high speed for withdrawal of the spindles and indexing and normal speed for the threading and forming operations.

That the grips open and close on a pivot parallel to the bolt serves to centralize and square the bolt and permits the gripping of long bolts close to the part to be threaded. An ejector is provided at the loading and unloading station to eject any bolt that fails to fall from the grips.

Other details in design include: The location of the threading head at the front of the machine, where it is screwed to the nose of the spindle and can be removed without dismounting the yoke. Accessibility of the forming head with the turret in its lowest position, with the pointing tool held and located by a clamping and a backing up screw and with a pointer for relocation of the turret. Positioning of the turret chucking unit for various lengths of bolts by means of an elevating screw. Control of length of bolt by adjustment of the graduated transfer bracket. Mounting of spindles in anti-friction bearings. Spindle slides in square bearings with tapered gibs. Centralized lubricating systems wherever possible. Collection of bolts and chips in separate compartments, with the doors of the compartments, when lowered, forming chutes to the containers.

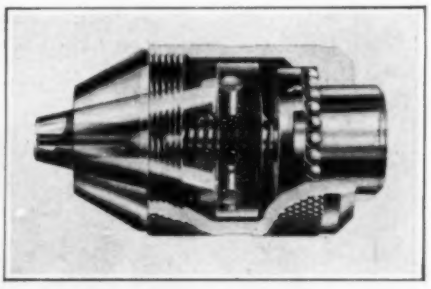
The machine can be arranged for loading at the front and unloading at the rear. When the machine is so arranged and delivery is made at the rear, a chute with an oscillating movement delivers the bolts to a tote box or container at the rear of the machine. Arrangements can also be made for loading and unloading of the bolts to suit individual shop conditions. Jamming, or interference, due to accident or improper set-up, is prevented by safety devices from damaging the machine. A worm on the cam drive shaft engages a wormwheel, into which is built a clutch consisting of several taper plungers backed by springs that compress when pressure through the cam mechanism is excessive. There is also a safety clutch in the driving pulley. Safety is provided to other parts by means of springs, for example to the transfer mechanism, the escapement, and ejector.

The floor space required is 40x66 in., and the net weight is 4,700 pounds.

Jacobs "Portomatic" Drill Chuck

A self-tightening chuck for use on portable, air- and electrically-driven drills and known as the "Portomatic" has been placed on the market by the Jacobs Manufacturing Company, Hartford, Conn. It is made in $\frac{1}{4}$-, $\frac{5}{16}$-, $\frac{3}{8}$- and $\frac{1}{2}$-in. sizes. All sizes are made to fit the new Jacobs standard tapers and threads, which cover all commercial portable tools of this nature.

All parts of the chuck are hardened, and all parts except the screw and the nut, or jaw-carrier, are



Jacobs "Portomatic" Drill Chuck

ground to finish dimensions after hardening. These latter parts are made of an alloy steel of special analysis and are heat-treated.

The screw is made integral with the body in which is the tapered or threaded hole by which the chuck is attached to an electric drill, and the wide flange that supports the lower ring of the ball bearing is also integral with this part. The jaw-carrier is threaded to fit the screw, on which it moves freely, having a range of movement between the flange and the nose

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piece of the chuck sufficient to open the jaws to their fullest capacity.

The inner ends of the jaws are rabbetted to slide on radial grooves to compensate for the varying center distances as the jaws open and close. The jaws fit closely in the jaw-holes of the nose piece, leaving no opening for chips to get into the interior of the chuck.

The features of the chuck are its ability to grip tightly the drill or other tool to be held without the use of a key, and its tendency to close itself upon the drill when the spindle of the driving tool is set in motion.

Defiance No. 727 Vertical 60-Ton Hydraulic Press

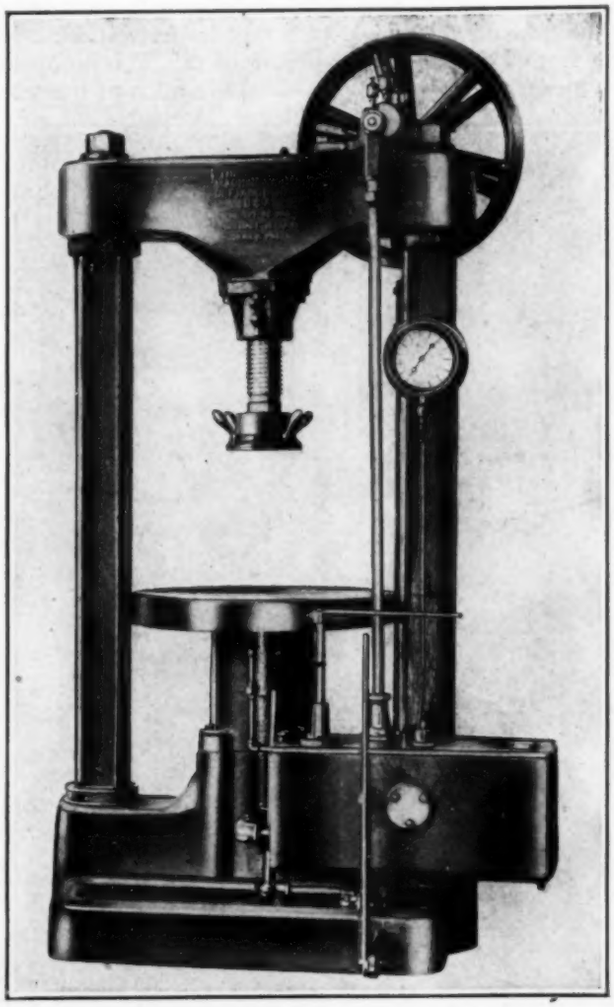
FOR general-purpose use in pressing objects together in automobile plants, wheel plants and other manufacturing establishments where a stroke of ram not to exceed 8 in. is required, the Defiance Machine Works, Defiance, Ohio, has developed the No. 727 vertical 60-ton hydraulic press, shown in the accompanying illustration.

The frame consists of a heavy cored base, a crosshead and two square columns. These columns are cast of semi-steel and are also of cored-section construction. The columns have large bearing surfaces at top and bottom to properly support the crosshead and the base. The base also has a wide floor spread to insure rigidity.

The crosshead at the top of the machine is held in place by two heavy stay bolts leading from the base through the column to the head. The head supports the drive mechanism and is fitted with a square thread screw 4 in. in diameter with 22 in. travel. The lower end of the screw is capped with a pressure block or head 8 in. in diameter with handles for up and down adjustment. The maximum distance from the top of the table to the under portion of the head of the screw is 22 in., while the minimum distance between columns is 29½ in. The working surface of the table top is 28 in. in diameter. Once properly adjusted, the screw can be locked into place. The hydraulic pump is of the double-acting type and is placed in a cast-iron tank fastened to the base. The tank is dust proof and serves as a container for the oil used in the hydraulic system. The pump is driven through a crankshaft and a long connecting rod to friction clutch which is controlled by a hand lever. The clutch pulley is 24 in. in diameter by 4 in. face and rotates at a speed of 400 r.p.m. A pressure gage, registering up to 60 tons, is provided to indicate pressure on the ram. An adjustable safety valve is attached to the pump and can be set to release the force at any desired pressure within the given capacity.

The ram is 8 in. in diameter and is fitted in a heavy cylinder cast integral with the base. The maximum vertical movement of the ram is 8 in. The lower end of the ram is fitted with cup leather packing held in place by a metal plate.

A 5-hp. motor is required to drive the unit. The floor space occupied is 55x40 in. and the weight is approximately 3,500 lb. net.

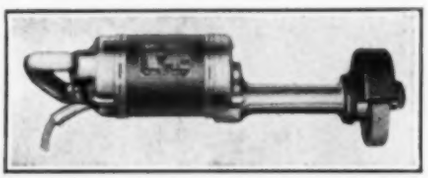


Defiance No. 727 Vertical 60-Ton Hydraulic Press with Integral Pump

"Hisey" Portable Grinder and Buffer

A ball-bearing motor and a roller bearing grinder spindle are featured in the ½-hp. portable grinder and buffer recently introduced by the Hisey-Wolf Machine Company, Cincinnati, Ohio. The motor was designed especially for this service and is of the universal type. It will operate on either direct current or single-phase alternating current of either 110 or 220 volts.

The no-load speed of the wheel is 3,800 r.p.m. A wheel 5 in. in diam. x ¾ in. face is used. The wheel guard is of cast steel and conforms in design with the A.E.S.C. standards. It is adjustable and can be placed at any angle for convenience of the operator. The end cover is readily removable.



"Hisey" Portable Grinder and Buffer

The unit is supplied with 10 ft. of all-rubber cable and a suitable attachment plug. The net weight of the unit with steel guard is 23 lb. The overall length is 22 inches.

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Sellers Horizontal, Boring, Drilling and Milling Machine With 7-Inch Spindle

THE horizontal, boring, drilling and milling machine shown was recently built by William Sellers & Co., Inc., Philadelphia, Pa. It is a heavy-duty machine and can be used on a large variety of work.

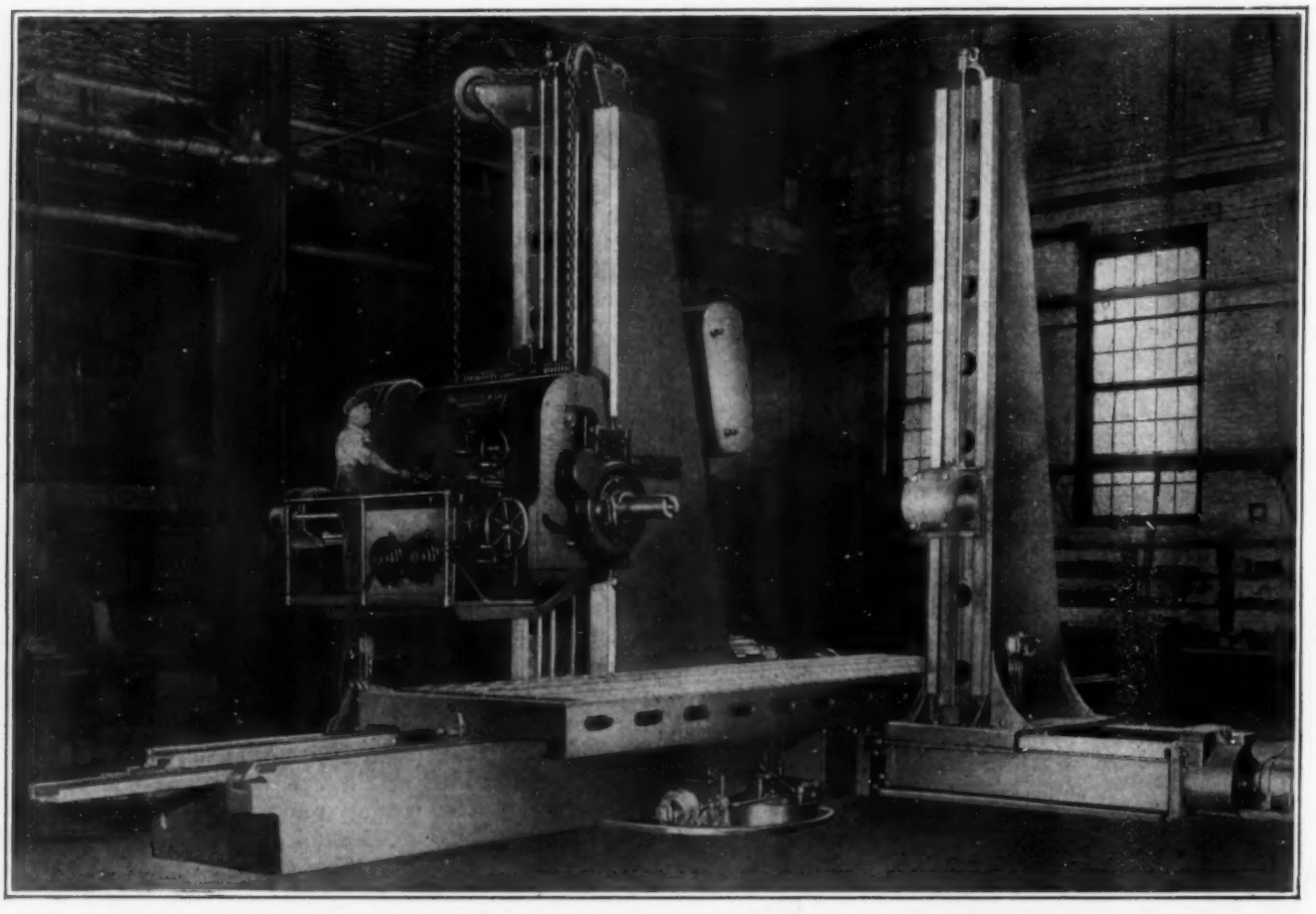
The work head is mounted on a heavy column or upright and is counterweighted for easy motion. Power traverse and a large series of milling feeds as well as boring and drilling feeds are available on the work head. A movable table, also provided with power traverse and milling feeds, carries the work. On the opposite side of the table from the work head there is an outboard support, consisting of an upright arranged to move to and from the table for various sizes of work. The bearing travels vertically in unison with the work head, except when milling.

The spindle on the work head is 7 in. in diameter, and it has 5 ft. of continuous stroke. Starting from a point 5 in. from the top of the table, the travel of the head vertically is 11 ft. The total travel of the table is 16 ft. It is 6 ft. wide by 18 ft. long and is provided with slots and stop holes for holding down the work. The spindle is carried close to the upright to give maximum rigidity and strength. It rotates in a sleeve upon which is mounted the driving gear, and is held in the sleeve by two bronze taper adjustable bushings and driven by two large keys.

The drive for the spindle is simple. A 15-hp. adjustable-speed motor is mounted directly on the work head and drives through a gear train made up entirely of spur gears. The shafts are all short and well supported by bronze bushed bearings. All gears and bearings are oiled from a central lubricating tank at the top of the head. Speeds ranging from 2 to 200 r.p.m. are possible by means of sliding gears in conjunction with the motor regulation. Drilling and boring feeds range from 1/192 in. to 1 in. per rev. of spindle. The same motor that drives the spindle provides power traverse of 7½ ft. per min. and milling feeds from ¼ to 18 in. per min. vertically. Quick power traverse and hand adjustment are also provided for moving the spindle in and out.

The upright that carries the work head is of box section with heavy walls and is ribbed to provide stiffness. The counterweight for the work head travels on tracks on the back of the upright and is connected to the head by heavy chains spaced so that the center gravity is midway between the points of attachment.

The work table is also of box section with top and bottom plates. It is carried on one flat and one double-V way. One of the Vs is at the usual angle and supports the weight of the table: the other V is above the first and its surfaces are inclined at an angle of 5 deg. to the vertical. The chief purpose of this V is to oppose any possible side motion of the table.



Sellers Horizontal, Boring, Drilling and Milling Machine With 7-Inch Spindle

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Holding-down shoes are arranged at both sides of the table to prevent lifting under heavy cuts when the work is high above the table.

Quick traverse and feed for the table is obtained by an adjustable-speed motor rated at 7½ hp. The drive is through the Sellers spiral pinion and angular rack. A gear box mounted at the side of the bed provides the changes of speed.

The machine has a number of safety features. One of these is the interlocking of the main motor with the motor for feeding the table. If the spindle motor through overload or any other reason should stop, the feed motor will instantly be shut down. Other safety features include limit stops provided at each end of the spindle travel to protect the mechanism against careless operation. The ways of the table and all bearings for driving shafts are fed by oil under pressure. Other bearings such as those in the change of speed box are oiled from a central tank by gravity.

Gridley Hydraulic Unit to Operate Chucks

A SELF-CONTAINED hydraulic device, the purpose of which is to operate the chucks of screw machines, chucking machines, automatic lathes and other production machinery that have hitherto been actuated pneumatically, has been brought out by the Gridley Machine Company, Hartford, Conn. The device, Fig. 1, is intended to stand on the floor and connect with the particular machine by a single pipe of suitable size to convey the oil. The only other connections required are by wire to an electrical outlet from which current of proper voltage and frequency for the small driving motor may be obtained, and by smaller wires to a push button located at any point upon the machine convenient to the operator.

The device consists of a cast-iron tank to hold a quantity of oil, and a cover to which is attached a motor-driven pump, an accumulator in which air pressure can be built up, suitable gages to indicate pressure, and valves to regulate the flow of oil. This mechanism lifts out with the cover, as seen in Fig. 2, and when in place is submerged in the oil contained in the tank.

A ¼-hp. electric motor is directly connected through a vertical shaft to a small rotary pump that is capable of delivering a limited quantity of oil at pressures that may be varied at will of the operator to suit conditions. The pump regularly furnished with the device is capable of delivering pressures up to 150 lb. per sq. inch.

Oil is delivered by the pump *A*, Fig. 2, to the bottom of the accumulator chamber *B* through a special valve the function of which is to allow oil to pass freely to the accumulator and at the same time to maintain full delivery pressure upon the chuck cylinder. This valve is uninfluenced by back pressure in the accumulator, hence the pressure in the chuck cylinder remains constant at whatever amount it may be set. This feature permits the grip of the chuck jaws to be regulated according to the nature of the work to be held; heavy pressures for tough forgings and lighter ones for fragile castings.

As the volume of oil in the accumulator chamber increases, pressure is built up against the air that is trapped in the accumulator chamber until the maximum pressure for which the valve is set is reached, after which oil is by-passed through the valve and no further change in the conditions prevailing in the accumulator and chuck cylinder takes place until the chuck is again operated.

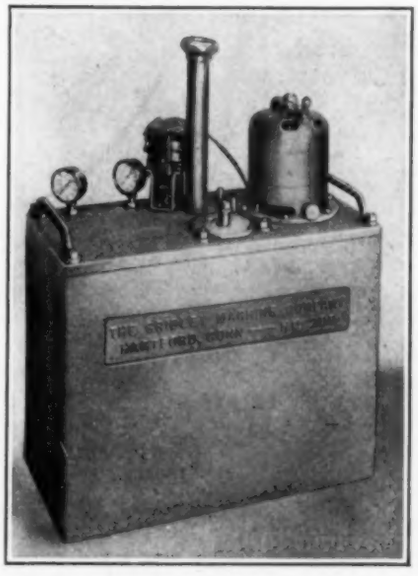

Fig. 1—Gridley Hydraulic Unit for Operating Chucks

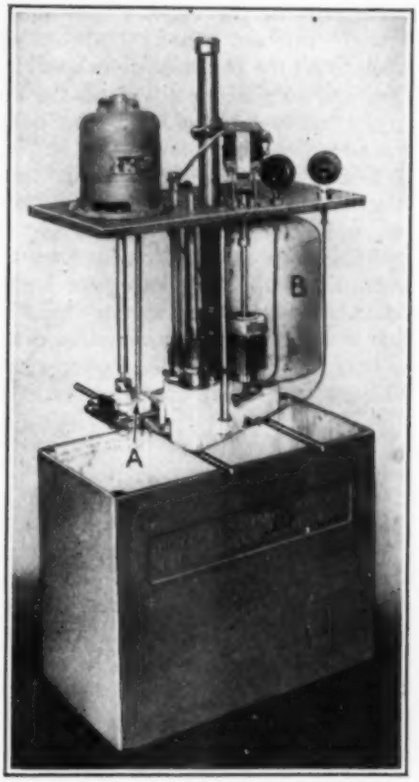

Fig. 2—Hydraulic unit with the cover lifted, showing the mechanism

Delivery of oil from the accumulator to the chuck cylinder is through a solenoid-operated, non-return valve that is controlled by the push-button on the machine. Current for the solenoid is taken from the motor leads, so that no separate electrical connection is required for this purpose.

The action of the device is as follows: To open the chuck the operator depresses the push-button, causing the solenoid-operated valve to open and allow the oil contained in the chuck cylinder to discharge into the tank. When pressure upon the button is released the valve returns to its normal position, thus putting the cylinder in direct communication with the accumulator and filling it instantly with oil by reason of the pneumatic pressure.

Though oil flows freely from the accumulator to the chuck cylinder it cannot flow back. It is the purpose of the constantly-running pump to hold the chuck closed by hydrostatic pressure. The pneumatic pressure of the accumulator merely fills the chuck cylinder with oil, and passes out of action until again required upon

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recurrence of the cycle. The pump, though far too small if depended upon to fill the chuck cylinder quickly, thus has ample time to return the oil to the accumulator and again build up the pressure of air therein.

The claims for this device are threefold: that by reason of the incompressible nature of the liquid medium through which power is transmitted to the chuck, the latter holds the work positively and firmly; that a minimum of power is required to operate the chuck because there is no loss from heat transference and absorption; and that there is no loss from leakage, as all working parts except the chuck cylinder itself are submerged in the tank.

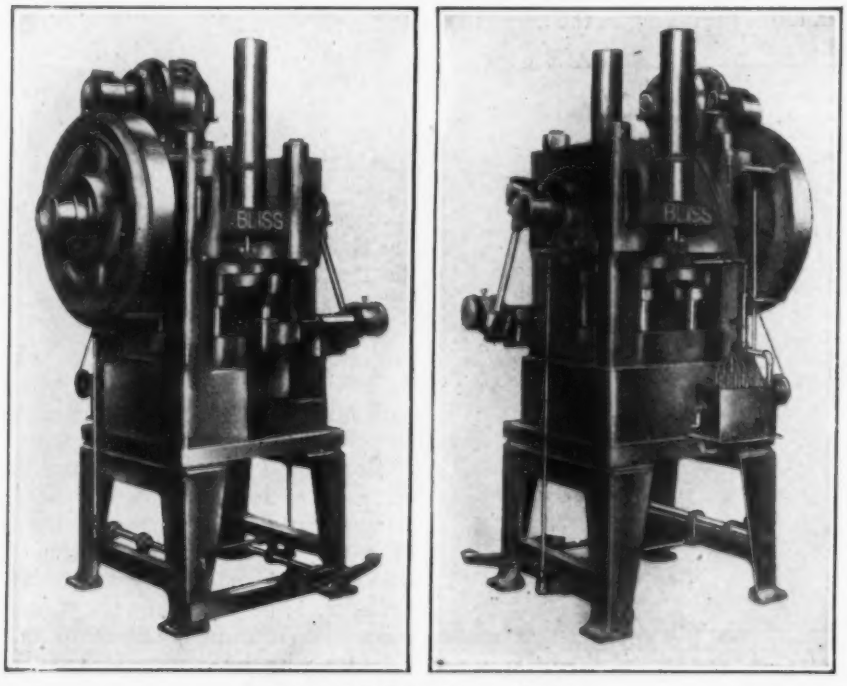
The device occupies a floor space of 12x24 in. and stands 18 in. high. The outfit includes a cylinder to be substituted for the air cylinder of the chuck to which it is to be applied. A pump to deliver pressures up to 300 lb. per sq.in. will be furnished instead of the smaller one if desired. Motors for electric current of any commercial voltage and frequency may be supplied.

Bliss High-Speed Punch Press

A HIGH-SPEED press operating at 300 strokes per min., designed particularly for punch press work, was recently placed on the market by the E. W. Bliss Company, Brooklyn, N. Y. A number of fundamental principles of design were used to increase the total life of the die by increasing materially the number of punchings per grind. The idea was to prevent spring of all parts under load.

As indicated in the illustration, showing a 50-ton model, the press is built with a massive frame, keyed in alignment and tied together with oversize tie rods. These rods are shrunk in the housings under an initial tension in excess of the rated load of the machine. The eccentric type shaft is supported close up to the crankpin. The frame, bed, crown and shaft are of such ample size that deflection under load is reduced to a negligible amount. Substantial sub-presses with large hardened and ground pins and bushings are used to insure accurate alignment on these parts.

The strokes of these presses are kept short, in order to keep down the working velocity of the punches. Because of the speed, all moving parts are kept compact, and their weight is counterbalanced by long, compound springs shown incased at the top of the machine. For the same reason, the distance from the face of the slide to the center line of the crankshaft is kept short. As in the case of the Stiles type presses made by this company, these machines are only for one class of work, largely blanking, and large adjustment is not required. The adjusting wedge provided, however, furnishes ample adjustment and is controlled by a screw with a disk graduated to facilitate fine settings.



Bliss High-Speed Punch Press

The machine is fitted with a standard Bliss high-speed rolling key clutch. The heat-treated alloy-steel rolling key presents a long and completely backed up surface to engage with the wheel bushing at a low lineal velocity, due to the closeness of the key to the center line of the shaft. For this type of service, special long clutches and latches are provided so that after the key is rolled out of engagement an extra long period is allowed for the brake to bring the shaft to rest before the positive stop hook reaches the latch recoil.

Any opening desired can be provided in the bed to drop the work straight through. The working parts are all on top, leaving the floor space about the machine unencumbered.

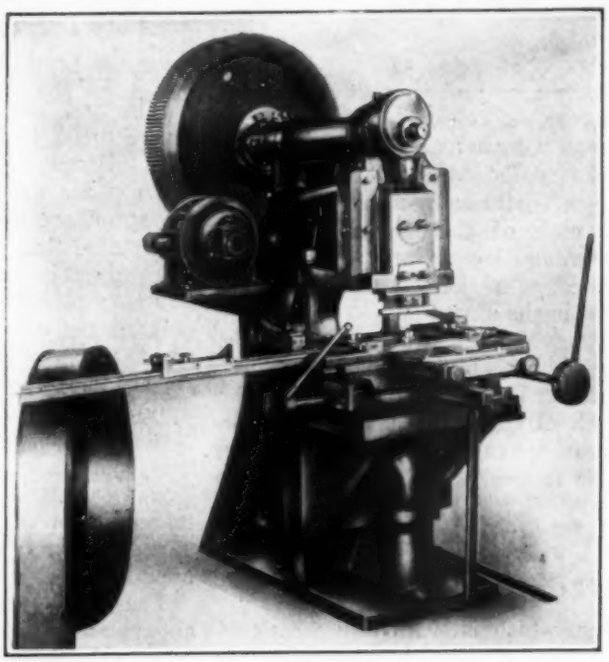
Mechanical feeds of several types can be furnished, including single- and double-roll feeds driven continuously or intermittently, magazine feeds, etc. The illustration shows the press equipped with a continuously operating single-roll feed driven through hardened spiral gears and equipped with a modified flying stop gage. The rolls are hollow and are hardened on the surface, and roller guides are provided. Adjustment of the roll relief is independent of the feed stroke adjustment, so that close settings are permitted. Friction drive with hardened rings and rollers, as used on the standard Bliss roll feeds, is used unless the single- or multiple-pawl ratchet type is preferred. The feed is arranged to operate either front and back or right and left across the bed as required, thus leaving the dies readily accessible. The sub-press is easily removable, if necessary, but need not be removed for changing dies.

The oiling system has been planned with care to provide ample lubrication at high speed, and at the same time economy of oil. Most of the bearing surfaces are steel or bronze, and provision is made to return the oil to the slide and thence through a strainer to the tank a positive feed pump is used to distribute the oil.

Shop Equipment News

"Semco" Improved No. P-25½ Press and Nibbling Machine

IN ORDER to provide a machine for handling the heavier gages now used in the fabrication of sheet metal, the Service Machine Company, 750 Broadway, Elizabeth, N. J., has placed on the market its No. P-25½ punching press of improved design, having a capacity of 30 tons pressure near the bottom of the stroke, an increase of about 50 per cent. The original machine was described on page 835, Vol. 63, of the *American Machinist*. Many of the distinctive features found in various types of presses are combined in this utility machine. The gap in the housing, or throat, is 20 in. deep from the center of the slide, so that sheets 36 in. wide can be pierced in the center, and at the same time there is room available for the use of adjustable back gages, which are an essential part of utility dies. The slide has an up and down adjustment of 3 in. to take care of the range of ordinary die sets. For those dies requiring it, a positive knockout can be incorporated in the machine slide.



"Semco" Improved No. P-25½ Press and Nibbling Machine

The bed, which is 16x24 in. in area, is a separate knee casting adjustable in height so as to provide die space varying from 6 to 14 in. This bed adjustment permits the setting of deep drawing and forming dies, or fixtures for lock seaming and curling operations on a large variety of work.

The clutch is so designed that when set for regular work it is safe in action. The stroke cannot be repeated until the treadle has returned to its dead position and is again depressed. The parts of the clutch are made of heat-treated tool steel, proportioned to give long life. An automobile-type brake, lined with Raybestos bands, is used in conjunction with the clutch to stop the machine. The eccentric shaft is a one-piece forging of alloy steel. Lubrication is provided to the flywheel and working parts from an oil reservoir.

The accompanying illustration shows a "Semco" No. P-25½ punch press equipped to function as a nibbling machine. The universal nibbling table is a separate attachment and is removable when the press is required for other work. To operate the nibbling table at a speed of about 200 r.p.m., a second driving pinion is provided for the motor, which has two settings on the motor bracket. The attachment consists of three parts: a lower casting bolted to the press bed, a middle section that slides forward and back, and a top table that has lateral traverse. The slides are provided with adjustable gibs for taking up wear, and are operated by means of a rack and pinion. Four-way adjustable gages and adjustable clamps are used to obtain quick and accurate setting of both flat and contour work. These gages have micrometer setting and positive lock to eliminate slippage.

The nibbling table is for particular use in jobbing shops where a small run of work is to be pierced with a given size and shape of opening, and where the expense of making a regular die is out of the question. The nibbling machine requires only the making of a template having the desired opening. This template is clamped in the front extension of the table, the gages are set and the work is run through at an average rate of three pieces per minute.

Bearium Processed Rods

Bearium metals made by Bearium Bearings, 261 Franklin St., Boston, Mass., are now available in solid rod form for making small bearings and bushings. The rods are available in sizes from ¼ to 1 in. in diameter in sixteenths, and up to 60 in. in length. The finish of this product is smooth and sufficiently accurate (standard to 0.002 in. large) for press fits on bushings and for any machine chucking work.

Bearium metal is an improved bearing bronze containing 26 per cent lead evenly distributed throughout the metal. It has an even and dense texture, high tensile strength and Brinell hardness, thereby giving it unusual wear resisting properties. A bearing made of this metal may be run dry for several hours without trouble and will run at a red heat without seizure or scoring of either bearing or shaft. The standard processed rod is of B-4 grade, designed for resistance to shock and impacts such as occur in heavy-duty machine tools, internal combustion engine bearings, and the like.

The rods were developed particularly for screw machine use, and are made long enough to prevent much loss in chucking due to small ends.

Morton Special Heavy-Duty Draw-Cut Shaper

A special heavy-duty draw-cut shaper for the production machining of pole pads on cast-steel motor magnet frames is announced by the Morton Manufacturing Company, Muskegon Heights, Mich. The illustration shows the left-hand view of this machine, with a special chuck-

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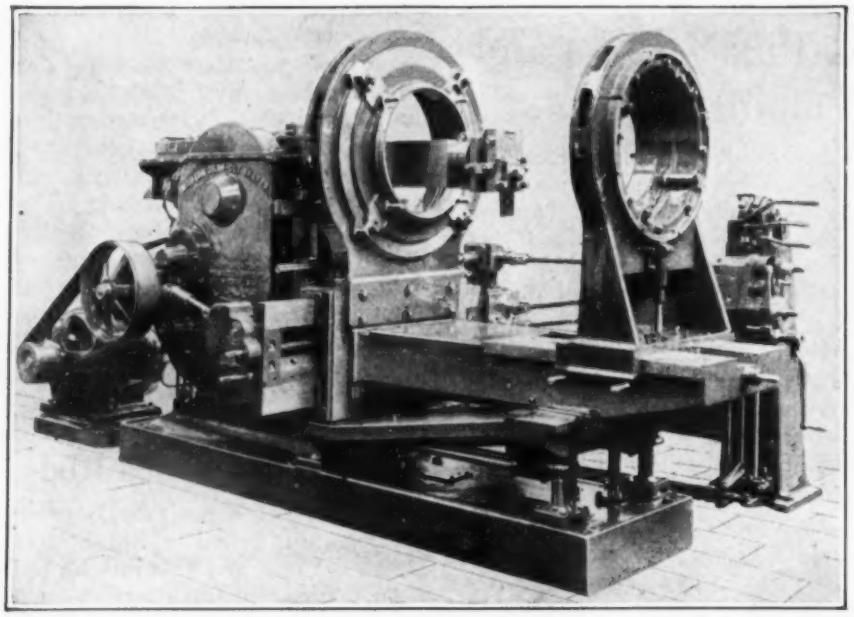


Morton Special Heavy-Duty Draw-Cut Shaper for machining pole pads on cast-steel motor magnet frames

ing attachment for holding the motor magnet frames.

Four vertical screws are used for raising and lowering the table. The machine has 60 in. of cutting stroke, and has power horizontal and vertical feeds, also automatic oiling, all of which is standard on Morton draw-cut machine tools. The motor magnet frames are quickly placed in the special chucks and are rotated by power feed into position for finishing each of the motor pads. All operating levers are conveniently located, as can be seen at the extreme right in the illustration.

The Morton draw-cut principle, which has been applied to this machine, is said to make possible the depth of cut and feeds necessary in removing cast-steel material from these frames.

Gisholt 1L Turret Lathe

BAR work up to 2½ in. in diameter and chucking work up to 12 in. can be machined on the 1L turret lathe made by the Gisholt Machine Company, Madison, Wis. The unit is similar in design to the larger 2L turret lathe described on page 379, of this volume of the *American Machinist*.

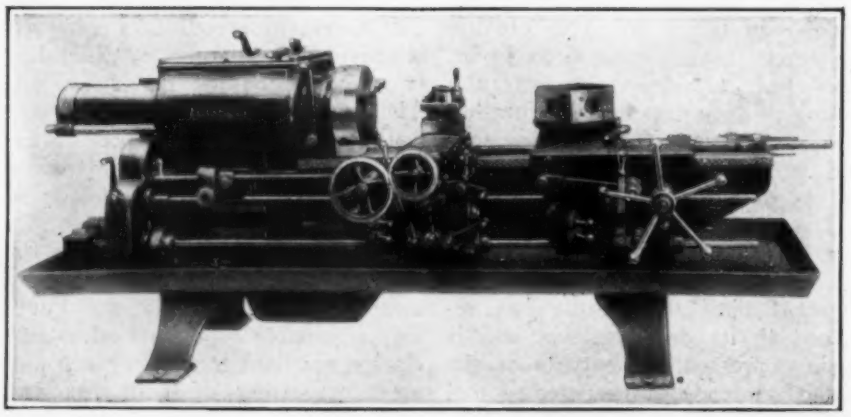
The headstock is of rectangular box design with walls carried well up above the spindle bearings. The headstock cover is a flat plate carrying only the operating levers. The spindle is mounted on tapered roller bearings, as are the headstock drive shaft, intermediate shaft and reverse shaft.

The drive is by a single pulley running at 600 r.p.m., and twelve spindle speeds ranging from 20 to 480 r.p.m. are provided through sliding gears and positive jaw clutches mounted on splined shafts. The spindle control lever, which is located just back of the spindle nose, is convenient to the operator's hand and operates a multiple-disk clutch on the drive shaft which, when in neutral, engages a brake that instantly stops the spindle. From the headstock to the final drive of the carriages, all power shafts are mounted on ball bearings. The upper of the two shafts along the front of the bed is for feed, while the lower one rotates at a higher speed and is for the rapid traverse.

The full universal, full-swing, two-carriage principle common to larger Gisholt turret lathes has been employed in the present design. A fixed-center turret is standard equipment and a cross-feeding turret is optional. Eight independent reversible feeds are incorporated in each apron and another complete range of eight feeds, each slightly coarser, is available through a lever at the headstock end.

Longitudinal rapid traverse is provided for both carriages, with automatic stops at the extremes of travel. Rapid traverse is also provided for the in and out movement of the square turret tool post on the cross-slide. Because of the fact that ball bearings are used, the feed gears in the apron are speeded up for rapid traverse so that no separate traverse mechanism is required. This construction permits rapid traverse not only to the side carriage, but also rapid traverse to the cross-slide. Engagement of the traverses is made through serrated tooth clutches of hardened steel, and a low power friction device is incorporated for safety. The two carriages may collide in traversing or be run against a dead stop without danger of any part breaking.

The square turret on the cross-slide automatically indexes one quarter turn as the clamping lever is released. The hollow hexagon turret is of thick section and is clamped to its base by a double bevel steel clamping ring operated by a compound toggle. A tapered index pin locates the turret



Gisholt 1L Turret Lathe

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holes central with the spindle, but the strain of the cut is entirely taken by the bevel clamp ring.

The ways of the bed are covered with hardened steel plates, ground in place. Each movement of the rapid traverse lever feeds a small amount of oil through the under side of the carriage to the ways, by means of a plunger pump in the apron. Dirt and chips are excluded by felt and brass wipers, so that the carriages always ride on a film of clean oil. The headstock gearing and clutches run in a bath of oil, a part of which is collected in a splash box, strained and carried to the spindle bearings. A Madison-Kipp automatic lubricator is used to supply the feed train and traverse drive with oil, while each apron contains its own oil reservoir from which its gears are constantly lubricated by the splash system.

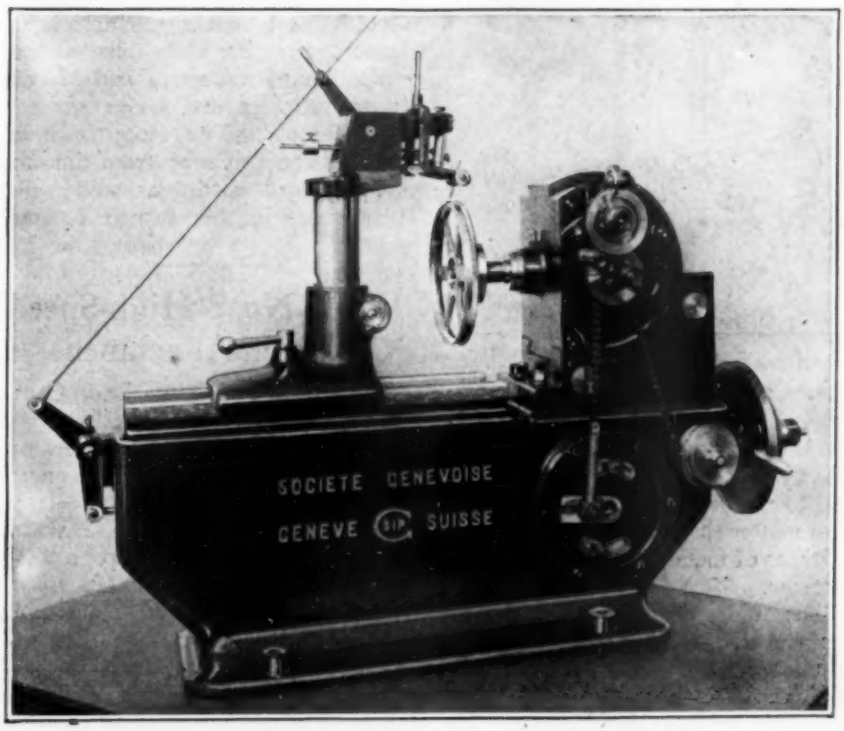
For electric drive the motor may be mounted either on the headstock or on a special backplate, and may be connected by Allis-Chalmers Texrope drive, flat belt or silent chain. A 3- to 7½-hp. motor, operating at 1,200 r.p.m., is recommended, according to requirements.

For bar work an improved power-operated bar feed is provided, consisting of a screw-driven carrier coupled by a cone friction clutch to the headstock drive. An automatic chuck with master collet and size pads and a 12-in., three-jaw universal chuck is standard equipment, but air chucks or wrenchless chucks may be supplied in addition. Other accessories include a taper attachment, a leadscrew thread chasing attachment, and a complete line of bar and chucking tools.

The maximum swing of the lathe is 17 in. over the ways and 14 in. over the side carriage, while the maximum distance from the face of the hexagon turret to the end of the spindle nose is 45 in. The machine without tools weighs 4,500 lb. net.

Société Genevoise High-Speed Drum Dividing Machine

THROUGH its American representative, the R. Y. Ferner Company, Investment Building, Washington, D. C., the Société Genevoise d'Instruments de Physique, of Geneva, Switzerland, is putting on the market Model No. 0065-1927 high-speed dividing machine for the graduation of drums. This machine differs from the old model in several respects, the most important of which is that it has been built primarily for speed rather than high accuracy. It may be used as a production machine for the graduating of micrometer drums for lathes, milling machines, and similar machine tools, or for testing machines. It can also be used for graduating beveled dials or cylindrical surfaces for electrical apparatus and other scientific apparatus where an accuracy of 1/20,000 of a revolution is sufficient.



Société Genevoise High-Speed Drum Dividing Machine

Instead of having the provision for tilting the tracelet through an angle for the ruling of beveled surfaces, the new machine has a tracelet permanently mounted in a horizontal position and has provision instead for tilting the work-holder through 90 deg. It is thus possible to rule lines on the surface of a flat disk as well as on a beveled dial of any angle of bevel or on cylindrical surfaces.

Cylindrical drums up to 10⅝ in. in diameter and 5½ in. in length may be graduated, or flat disks up to 20⅞ in. in diameter, and 2 in. in height, may be handled. The capacity for beveled dies depends partly on the angle of the bevel, but for one with a 45-deg. bevel, dials up to 6 1/16 in. may be mounted in the machine. In all cases, lines up to 1 in. in length, from 0.004 to 0.008 in. in width, and of a depth of 0.006 in. may be made.

The tracelet is of an extra-rapid precision type and is mounted on a column adjustable vertically according to the diameter of the work piece. The whole column can be moved forward or backward on the bed of the machine, so as to position the tool horizontally.

The pieces to be graduated may be fixed either in chucks to be secured in the hollow axle of the dividing head, or on mandrels when working on a series of pieces. The worm screw that drives the toothed spacing wheel is completely inclosed in a cast-iron housing, which can be tilted from the vertical to the horizontal position. Its inclination is read on a graduation in degrees. The dividing worm has 90 teeth, or one for each 4 deg. Two ratchet wheels for the worm screw are provided, of 100 and 120 teeth respectively, and three ratchet wheels for the tracelet of 20, 24, and 32 teeth.

Notched disks for the tracelet, by means of which the relative lengths and frequency of the different lines

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are controlled, are also furnished, having 8, 10, 12, and 16 notches, as well as one without any notches. With this equipment, it is possible to graduate any usual combination of lines with any of the common spacings. The interval between two lines may be as great as 6 deg., or 60 deg., according to the circumference. Special ratchet wheels for unusual spacings can be furnished extra.

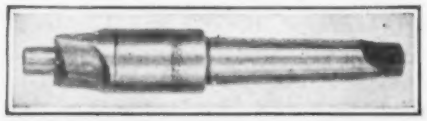
The graduations may be ruled at a speed as high as 100 lines per min., although 80 lines per min. is normal speed. Guaranteed accuracy of spacing of the lines at the high speed is 1 min. of arc, while at the lower speeds the accuracy may be as high as 40 or 30 sec. of arc. The machine is driven by a 4-step groove pulley using a round belt. The speeds of the pulley are varied from 400 to 1,600 r.p.m. A $\frac{1}{3}$-hp. motor is required to drive.

Besides the parts mentioned above, the regular accessories supplied with the machine include a centering mandrel with conical section for centering the workpieces to be graduated, two carbon-steel tracing tools, and a set of assembling and serving wrenches. The regular mandrel is 1 in. in diameter. Other sizes can be furnished, as well as chucks for holding work pieces with a clamping capacity up to $1\frac{1}{2}$ in., sets of taps of the special trapezoidal thread used in the draw-in bar of the dividing axle, and spare tracing tools and special disks and ratchet wheels.

The overall dimensions of the machine are 42x13 in. and its height 33 in. Its weight is 345 lb. net.

Scully-Jones Counterbores and Spot Facers

As in other tools made by Scully-Jones & Co., 1901-1913 South Rockwell St., Chicago, Ill., this counterbore features the principle of "drive by the square and center by the shank." The square driving portion of the cutter is located immediately behind the cutting edge and the shank extends beyond this portion into the body of the taper driver shank.



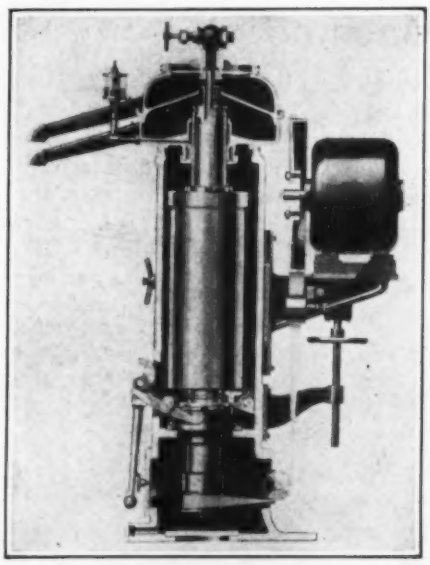
Scully-Jones Counterbore and Spot Facer

Standard Morse tapers are regularly supplied, but any special shank can be had on request.

The counterbores range in size from $\frac{1}{4}$ to 3 in. in diameter, and the end pilots from $\frac{1}{4}$ to $1\frac{7}{8}$ in. The pilots are hardened and ground on the diameter, but the stems are left soft to reduce breakage. Centers are provided at both ends so that the pilots can be ground to any special diameter. The driver is also hardend and ground.

"Positive" Separator and Clarifier for Cutting and Lubricating Oils

This centrifugal separator, which is easily convertible into a filtering clarifier, is for particular use with batteries of machine tools using quantities of cutting oil or compound. It was recently introduced by the "Positive" Machinery Division of the National Acme Company, Cleveland, Ohio. The "Positive" machine is intended to take oil or compound which



"Positive" Separator and Clarifier for Cutting and Lubricating Oils

has been passed through the ordinary gravity or centrifugal chip separator, and to remove from it all of the foreign matter that remains, such as fine particles of metal, dirt, and sand from castings.

The unit operates through the medium of revolving tubes or sleeves through which the liquid flows and against the inner surfaces of which it is held by centrifugal action. The centrifugal force drives to the surface of the cylinders the heavy foreign matter and at the same time a high pressure is built up which drives the liquid lengthwise along the tubes. It travels in this way over 100 in. before it is discharged and in this travel is thoroughly rid of all particles held in suspension at the beginning of its travel.

Dams or rings of suitable height hold back the sludge or the impurities and this material, from time to time, is cleaned from the inner surfaces of the tubes. The tubes are very quickly removable for cleaning and have a large capacity for holding the impurities so that very frequent cleaning is not necessary.

When used as a clarifier a filtering sleeve of filter paper or other similar material is placed between the inner and outer revolving sleeves of the machine. The hydraulic pressure developed in rotation then drives the liquid through the filtering sleeve at a high rate, thereby adding to the centrifugal action a secondary filtering action which eliminates even the very finest foreign matter.

While the value of machines of this type has been known for some time to manufacturers of paint and varnish, their application in metal working plants is quite novel. Tests in several shop installations already in daily use show, as a result of the use of this separator, marked savings in cutting oil or compound, longer life of the cutting tools (due to the elimination of abrasion) and longer life to bearings and slides of the machine tools. The same Positive machines are also used from time to time to clean used lubricating oil. Their value in this respect is self evident.

"Ettco" No. 3 High-Speed Tapping Attachment

The Eastern Tube & Tool Company, 584 Johnson Ave., Brooklyn, N. Y., are now making deliveries on the No. 3 size "Ettco" high-speed sensitive tapping attachment. It is similar in design to the No. 2 model which was described on page 717, Vol. 66, of the *American Machinist*. The range of taps of the No. 3 unit is from 0 to $\frac{5}{8}$ inch.

The tapper incorporates a leather-lined cone clutch and a cast-iron driving cone which has a smoothness of

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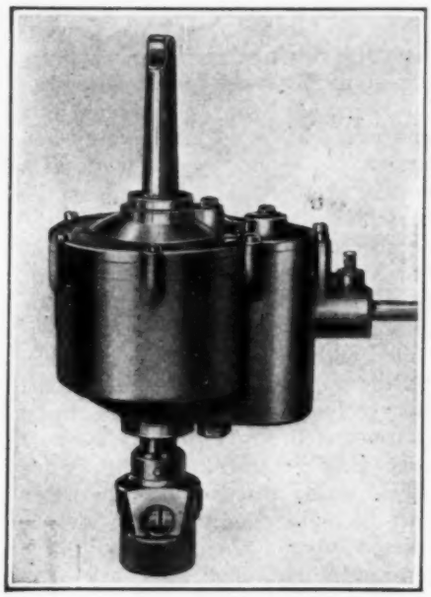


"Ettco" No. 3 High-Speed Tapping Attachment

action and a slipping point designed to prevent tap breakage. The operator can enter or stop a tap at whatever speed is desired regardless of the speed of the drill press by regulating the press lever. If a tap sticks or hits the bottom of a hole, the clutch slips. Similarly, if it sticks backing out, the reverse cone slips.

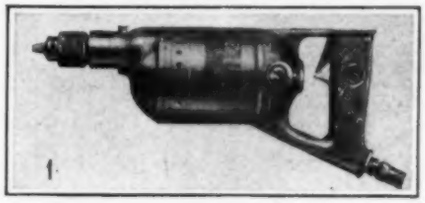
The reverse is made at twice the speed required for forward tapping. By locking the threaded Morse shank in the tapper, the left-hand threads can be tapped as readily as right-hand ones. An aluminum case and light, alloy-steel parts are used to reduce the weight, so that the unit can be applied to light drill presses.

It is claimed by the manufacturer that on some work this tapping attachment will increase the production from 100 to 500 per cent.

"Standard" Portable Electric Drills

A line of portable electric drills was recently placed on the market by the Standard Electrical Tool Company, 1338 West 8th St., Cincinnati, Ohio. It is made in two types and five ranges of sizes. In Fig. 1 the $\frac{5}{16}$-in. size is shown. This is typical of the $\frac{1}{4}$-in. size, also. Fig. 2 shows a typical unit of the range of $\frac{3}{4}$-, $\frac{7}{8}$- and 1-in. heavy-duty sizes.

The motors are manufactured by the General Electric Company, and are of the universal type for use on either direct or alternating current. The gears are made of chrome-nickel steel and run in grease while the shafts are mounted on SKF ball bearings. The motor housings are made entirely of aluminum to lighten the weight. The weights of the drills are $7\frac{3}{4}$, $8\frac{1}{2}$, 23, 24 and 25 lb., respectively,



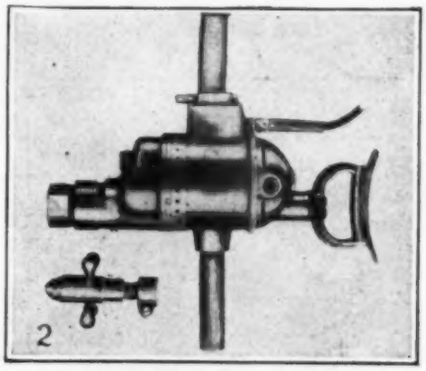


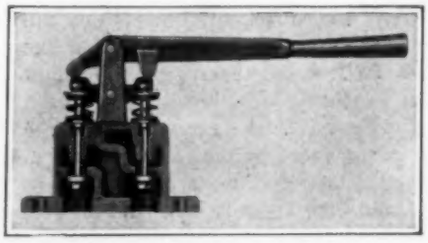
Fig 1—"Standard" $\frac{5}{16}$-Inch Portable Electric Drill. Fig. 2—The $\frac{3}{4}$-Inch Model

for the $\frac{1}{4}$-, $\frac{5}{16}$-, $\frac{3}{4}$-, $\frac{7}{8}$- and 1-in. sizes. The capacities given are for drilling in steel.

As can be seen in the illustration, the $\frac{1}{4}$- and $\frac{5}{16}$-in. drills have a grip handle with a switch mounted therein. The three larger sizes are equipped with a Morse taper socket, spade handle and a feed screw.

Ross Pneumatic Operating Valves

Three- and four-way operating valves for the control of single- and double-acting air cylinders are being manufactured by the Ross Operating Valve Company, 6488 Epworth Boulevard, Detroit, Mich. The poppet principle, with the air pressure against the poppet, is one feature of the design. They can be furnished in either locking or non-locking types and will find their own neutral or "off" position.



Ross Operating Valve

All ports are located on one face, so that the user can mount the valve in a plate to which the piping is attached. This construction makes the piping a permanent installation and in order to remove a valve it is only necessary to loosen the bolts that hold it in place.

The valve design includes a flexible seat and thus eliminates the necessity for lapping or grinding when servicing is required. The valve can be taken from the line, repaired and placed in operation again in a few moments time.

For double-acting cylinders, Style 5-P is made in four sizes, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$ and $1\frac{1}{4}$ in. Style 3-P for single-acting cylinders is also made in these four sizes. The size number has reference to the pipe size of the circuit.

General Electric Single-Operator Type Welder

A single-operator type welder, rated at 300 amp., is announced by the General Electric Company, Schenectady, N. Y., as the latest addition to its standard line of welding equipment. This machine includes a four-bearing, ball-bearing, motor-generator set with a flexible coupling. With this equipment the manufacturers claim a rapid and simple interchange of motors may be made by the user. As a result, inspection, maintenance, renewals and changes caused by changes in the supply circuit are simplified.

The generator is rated at 300 amp., one hour, 50 deg. C., and the driving motor at 15 hp., 40 deg. C., continuous-rating, in conformance with the ruling of the National Electric Manufacturers Association. The generator is so designed that field control is unnecessary and therefore is eliminated. The generator panel includes an ammeter and a voltmeter, but not the customary field rheostat. The meters used have a metal front, except for the glass over the scale, thus minimizing the possibility of breakage.

The motor starters for the 60-, 50- and 25-cycle motors are of the

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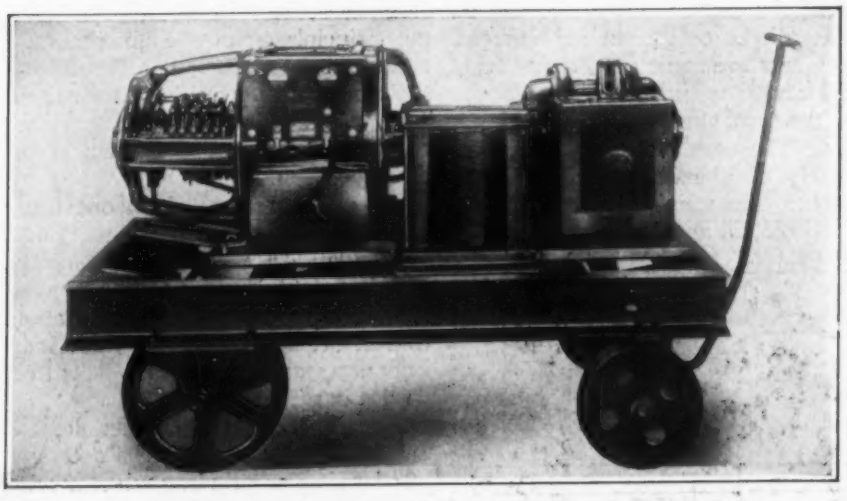


General Electric Single-Operator Type Welder, Portable Type

closed magnetic type. The d.c. motors use a simple resistance starter with a line switch. Starting current is maintained well within the N.E.L.A. requirements in each case.

The generator is designed to permit either belt, motor or engine drive and is either for stationary or portable use. It can be used as both a manufacturing and repair tool in any field where iron or steel is used. The designation WD-300-A has been given it by the manufacturers.

A. F. K. Vise Work Support

The vise work support illustrated is intended to materially increase the holding power of a vise, especially on work of an eccentric shape or on stock with very little gripping surface. It is made by the A. F. K. Fountain Works, Milwaukee, Wis. The support is quickly attached to the vise and can be readily removed. Fig. 1 shows the support itself and Fig. 2 shows how it is applied to hold thin brass tubing without crushing.

The supporting yoke is made of nickel steel, case-hardened to prevent distortion. Two adjustable malleable-iron clamps hold the yoke to the vise jaws and two helical torsion springs allow the jaws to be moved in and out to accommodate stock from $\frac{1}{4}$ to 2 in. in diameter without disturbing the setting of the support. The clamps can be adjusted for attachment to jaws 3x1 in. up to 7x2 in. The additional support for the work is obtained from the looped end of the yoke.

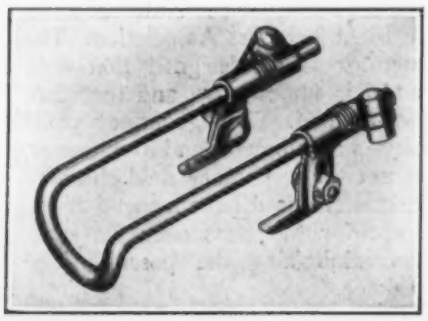


Fig. 1—A. F. K. Vise Work Support

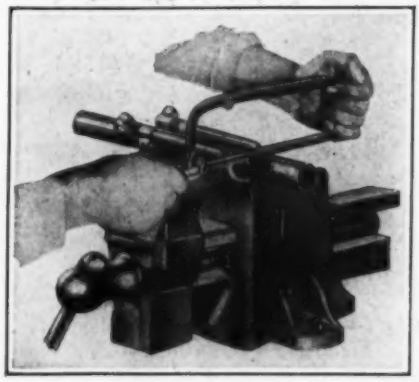


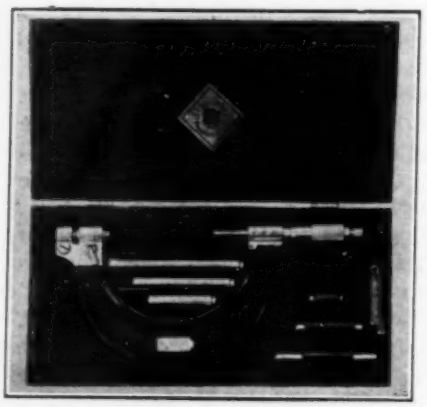
Fig. 2—Thin brass tubing being held with the support

Slocomb No. 45 Micrometer

Any measurement up to 4 in. can be read directly in numerals on the No. 45 micrometer recently brought out by the J. T. Slocomb Company, Providence, R. I., especially for use in garages and by motor mechanics in general.

The dial from which the figures are read is the regular direct-reading device applied by this company to other tools of like nature. It consists of a row of three figures appearing in small round apertures located in the spindle end of the bow in a position to be read conveniently when the tool is applied to the work in a normal manner. The divisions on the barrel are omitted, leaving only the parallel zero line. The bevel edge of the sleeve, or thimble, carries the usual 25 divisions, so that half or quarter thousandths are easily estimated with reference to the zero line. At the opposite end of the bow, the enlarged shoulder is divided by a transverse cut into two parts, the rear part being threaded longitudinally for an adjusting screw, while the other part is split longitudinally and is clamped upon a removable anvil piece by means of a small lever.

Four of these anvil pieces are provided to cover the range of measurement from 4 in. down to zero. They may be interchanged by merely loosening the clamping lever and substituting the anvil of desired length. In each case the anvil abuts against the adjusting screw, which is used only to make correction for errors such as would be introduced by reason of wear.



Slocomb No. 45 Micrometer

As the point of contact between the anvil and the adjusting screw lies midway of the transverse slot and is open to observation, any small particle of dirt that may intervene between the contacting surfaces is easily seen and removed by means of a strip of paper placed between the anvil and the screw. To insure accurate placing of the anvil, there are three end measuring gages, 1, 2 and 3 in. long, respectively. As can be seen in the illustration, the set is packed in a wood case which contains also a spanner wrench for adjustments.

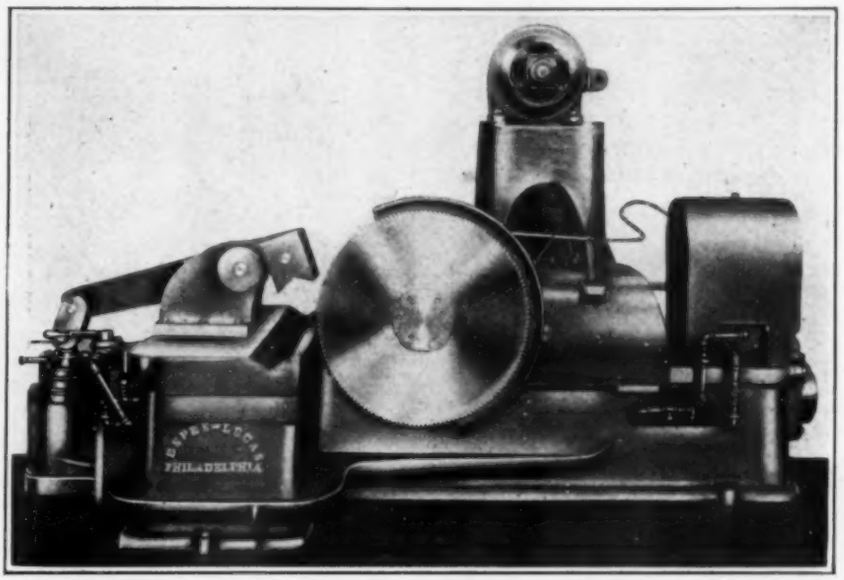
Shop Equipment News

Espen-Lucas Semi-Automatic High-Speed Production Sawing Machine

Fast sawing, quick-handling of material and of the machine between saw cuts are featured in this semi-automatic production sawing machine made by the Espen-Lucas Machine Works, Philadelphia, Pa.

It was designed expressly for cropping ends and sawing to length cast, solid and tube billets, and for supplying billets to an extruding mill at the rate of two billets per minute. The machine will saw through a solid billet 7 in. in diameter in 7 sec., plus 3 sec. for clamping and unclamping. The output is largely dependent upon the facilities for passing the work through the machine. With suitable apparatus, a complete cycle of operations can be made in 15 seconds.

Quick return as well as quick feed traverse to the saw carriage is accomplished by an Espen-Lucas low-pressure hydraulic oil feed system. Quick-acting clamps can be controlled either by air or oil pressure. The controls are all located at the table end, and the material may be passed through the machine without the workman touching it.



Espen-Lucas Semi-Automatic High-Speed Production Sawing Machine

Fosdick Friction Tapper

The patented friction tapper illustrated has been designed for use on the high-speed sensitive drilling machines manufacturing by the Fosdick Machine Tool Company, Cincinnati, Ohio. It is applied to the lower end of the spindle sleeve. With this tapping mechanism it is possible to tap to the bottom of holes without danger of tap breakage, even though the holes should vary in depth.

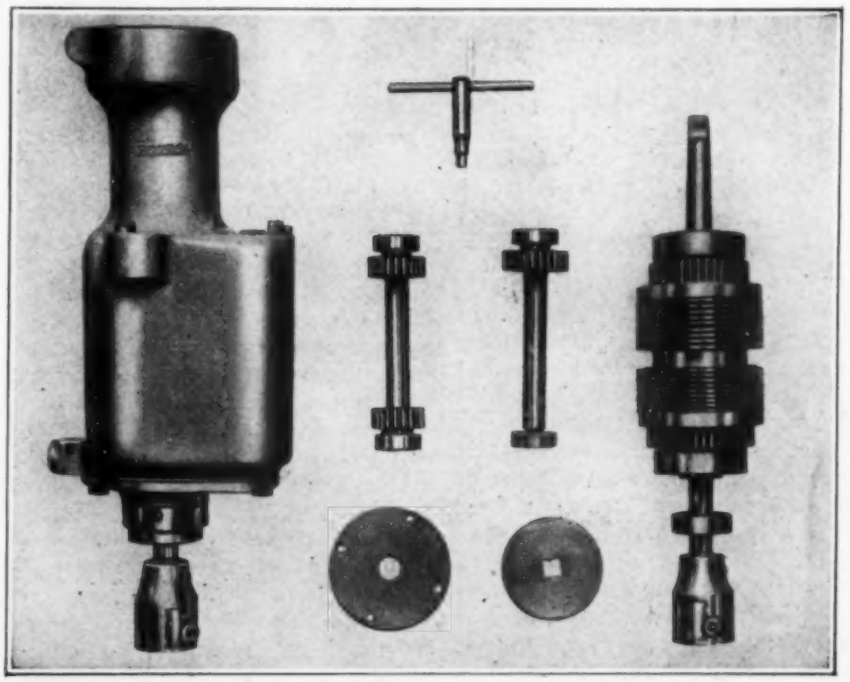
The tap operates efficiently at whatever speed the machine is running. The forward and reverse mechanism consists of two sensitive, but powerful, self-adjusting, multiple-disk frictions running in oil. Downward pressure on the feed lever drives the tap forward while the upward pressure reverses the tap for backing out. The adjustable depth stop on the spindle sleeve is used for accurate depth tapping. Ball bearings are used on all revolving parts.

These tappers are made in three sizes, the smallest having a capacity of $\frac{3}{16}$ in. at 3,000 r.p.m., the next largest in size having a capacity of $\frac{3}{16}$ in. at 1,500 r.p.m., and the largest having a capacity of $\frac{1}{2}$ in. at 500 rev. per minute.

Noble & Westbrook Special Marking Machine

A special marking machine was recently built by the Noble & Westbrook Manufacturing Co., Hartford, Conn., for marking bowling balls of different sizes with a trade name and a serial number. This marking is put on with the use of a special marking die in combination with an automatic numbering head. The wheels of the numbering head in the die are set to a bevel so as to mark on the circumference of the hard rubber ball.

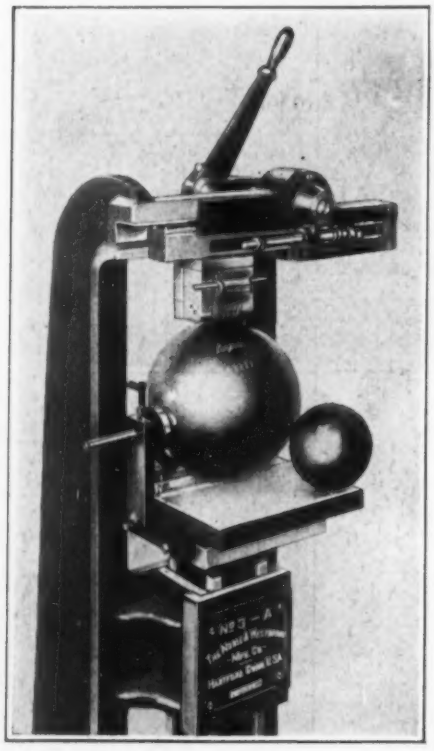
The special numbering head is equipped to work automatically and one figure is advanced at each depression of the lever. The four serial number wheels are preceded by a letter wheel. The table or holding



Fosdick Friction Tapper and its various parts

Shop Equipment News

fixture is provided with a roller bearing slide and two adjustable stops to permit the balls to be placed in a central position under the numbering head. The pressure is applied to the machine through a treadle, as in other standard marking machines made by



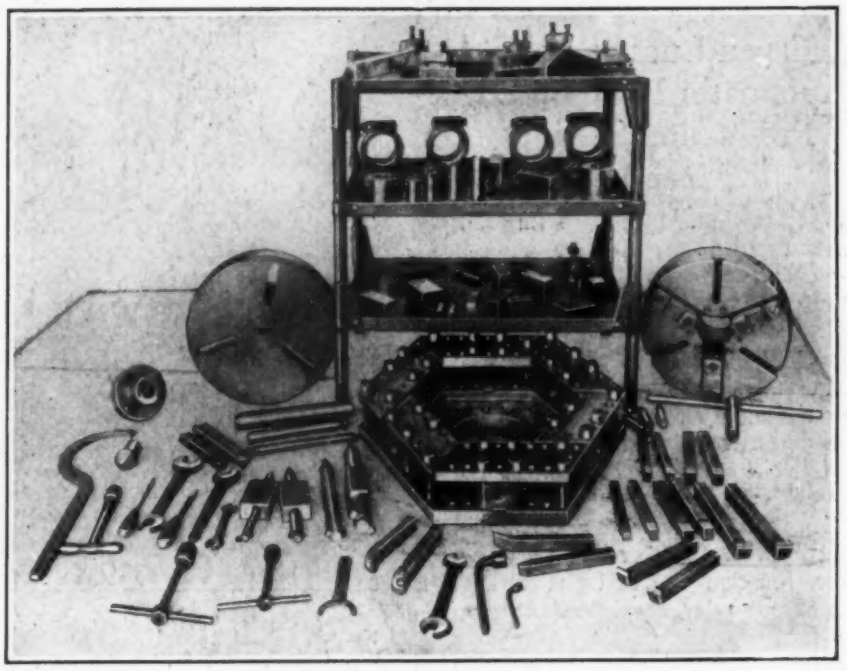
Noble & Westbrook Special Marking Machine

this company. The mark is made by pulling the handle which rotates the ball on the roller-bearing fixture, thus placing both the name and the serial number on the ball in a single operation.

Chucking Outfit for Hartness Flat Turret Lathes

Standard outfits of chucking tools for the 12-, 15- and 17-in. Hartness flat turret lathes have been developed by the Jones & Lamson Machine Company, Springfield, Vt., for use in handling the general run of work that comes to the ordinary turret lathe, so that the purchaser of a chucking lathe will be able to use his machine at once without the use of special tools. There is a sufficient number of tools in the outfit to allow a full variety of multiple tooling on complicated work.

The forged tools supplied with the outfit are made of larger sizes



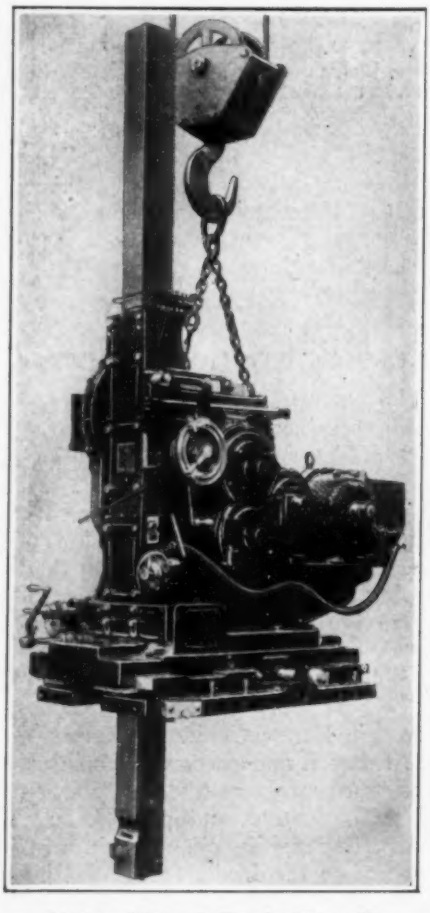
Chucking Outfit for Hartness Flat Turret Lathes

than furnished previously. The tool holders are of a new and rigid design and utilize standard tool bits. On the 12- and 15-in. machine and on the 17-in. machine with a round turret, the tool plate is now made in one large ring rather than in sectors as before. This construction results in increased rigidity in the tool mounting. The solid ring will be supplied with the standard chucking outfit. For combination bar and chucking work or for cases where special tools are to be used, the segments will be used.

Morton 72-Inch Stroke Portable Keyway Cutter

In the illustration is shown a right-side view of a portable keyway cutter having 72 in. of cutting stroke, recently placed on the market by the Morton Manufacturing Company, Muskegon Heights, Mich. The push-button control and tappet disk for adjusting the stroke, as well as the automatic oiling system, can be seen. Because of the extended drawbar, the unit is shown suspended from a crane hook. The position of the floor line is obvious.

This portable keyway cutter has 8 in. of out and in feed. The smallest hole the ram will pass through is 10 in. in diameter. Seven cutters, ranging in size from 2½ to 4 in. wide, inclusive, with variations of ¼ in., are furnished with the machine.



Morton 72-Inch Stroke Portable Keyway Cutter

The ram cuts on the upward stroke, drawing the work against the base of the machine. This design is said to insure accurate cuts.

NEWS OF THE WEEK

Philadelphia Engineers Celebrate Anniversary

The golden anniversary of the Philadelphia Engineers Club was celebrated on Dec. 16 and 17. Leading engineers from all parts of the country gathered as the guests of the club to hear the addresses and to celebrate the event in an atmosphere of admiration for one of America's most successful engineering organizations. The sessions were held in the Bellevue-Stratford Hotel, except for a convocation at the University of Pennsylvania where the honorary degree of doctor of laws was conferred upon three distinguished engineers.

Engineering of the past was pictured at the first session by Willard Chevalier, general manager of *Engineering News-Record*, and Ambrose Swasey, past president of the A.S.M.E.

On Saturday morning Josiah Penniman, provost of the University of Pennsylvania, conferred the honorary LL.D. degree upon Howard Elliott, chairman of the board, Northern Pacific Railway; John Hayes Hammond, mining engineer; and Charles M. Schwab, industrial leader and president of the American Iron and Steel Institute.

Speaking at the luncheon, Frank B. Jewett, vice-president of the American Telephone and Telegraph Co., appraised the engineering achievements of today. In the evening, at a formal dinner attended by four hundred members and guests, J. H. M. Andrews, president of the club, conferred honorary life membership on Charles Billin, who was a prime mover in organizing the club and has been its secretary throughout its half century of existence. This was followed by two addresses in which Dr. Samuel Rea, honorary member of the club and past president of the Pennsylvania Railroad and Dean Dexter S. Kimball, of Cornell University, exterpolated present trends to sketch an engineering picture of 1977.

Col. Chevalier, first speaker at the Friday night session, discussed the effect of engineering progress on civilization. He defined engineering as the application of science to the meeting of economic and social needs. He listed management, finance, production, merchandising and research as the agencies by which science is applied.

Ambrose Swasey brought to life the engineering achievements of 1877. The Centennial Exposition, held in Philadelphia in 1876, marked the great achievements of that era and incidentally led to the founding of the Philadelphia Engineers Club in the following year. There, as Dr. Swasey reminded his hearers, were displayed the harvester, the telephone and phonograph, and a mighty Corliss engine, weighing 600 tons and developing 1,400 hp. The air brake invented by George Westinghouse came into use about this time. Shortly after the great John Fritz installed at Bethlehem the open-hearth furnace, and three-high roll and a 125-ton hammer.

The address of Dean Kimball was notable for its development and application to the future of a new type of economic thinking that has sprung largely from the work of the engineer. The facts, he showed, have overthrown some of the accepted economic theories but have never budged the "law of diminishing returns," which states that for every great economic gain there is a loss which restricts that gain. "In the building of America's great wealth," said Dean Kimball, "engineering has made itself felt particularly through machine tools and power supply." There are, he said, still great opportunities to extend the application and efficiency of machine tools, but the law of diminishing returns places an ultimate limit. As to power, capacity may be limited only by demand, but gains in economy must necessarily slow down as theoretical limitations are approached.

Small Concerns Lead in Business Volume

Despite the conspicuous part played by large scale enterprise in American economic life, the bulk of business of all kinds is still being carried on by relatively small concerns. Even in manufacturing, where large scale production is the dominant factor, as measured by output and number of employees, the moderate sized plant remains the typical unit, according to the National Industrial Conference Board.

While the growth of large scale business has been most notable in manufacturing, nearly three-fourths of all manufacturing plants in 1923 employed only 20 wage earners or less each, and about two-thirds of all plants produced goods not exceeding $100,000 in value each during the year. The dominant part played by large scale production, however, can be appraised by the fact that, on basis of 1925 data, it takes only about one-third in number of all manufacturing plants to turn out nine-tenths, in value, of all products, and that this one-third of all plants employs nearly nine-tenths of all wage earners in the industry. While thus a factory employing 1,000 wage earners may be more important than 100 employing 10 workers each, significance is attached to the fact that large and small concerns exist in a highly competitive market.

Plan Further Study of Engineering Education

The board of investigation and coordination of the Society for the Promotion of Engineering Education announces that a special fund of $30,000 has been provided by certain educational institutions and the Carnegie Corporation for a parallel project to the investigation of engineering education recently conducted by the colleges. The new inquiry, as stated in the proposals which form the basis of the grant, is to be directed to the following ends:

(1) To indicate the character and the extent of the need in the United States for a type of technological education having the following general characteristics—More advanced than the work of the secondary schools; affording a general preparation for technical, supervisory and commercial services in industry, rather than specific training for skilled trades and occupations; differing from the programs of the engineering colleges by being briefer, more intensive and more direct in method, less theoretical and more strictly technical in content and not leading to an academic degree; principally full-time and co-operative day courses, but not excluding evening and extension courses organized into extended curricula.

(2) To indicate the extent and character of the present facilities for giving education of this character and to appraise their effectiveness.

(3) To indicate the means by which the needs may be met more adequately.

(4) To indicate how institutions giving this type of technological education and the present engineering college may supplement each other so as to create a well-balanced system of higher technical education.

(5) To indicate how the public educational authorities, the professional societies of engineers and industrial bodies may aid in establishing this type of education on a stable and adequate basis.

In defining the scope of the inquiry, attention was directed primarily to a type of education, rather than a type of institution. Many agencies now have some share in this form of education and the inquiry will seek to ascertain what their contributions are and how fully they meet the general need.

In line with the policy pursued in other investigations by the society, a special advisory committee will be constituted, representing the interests most directly affected. Active co-operation will be sought from the technical institutes, extension schools, industries and public educational authorities.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry

By THEODORE H. PRICE
Editor, Commerce and Finance, New York

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A LONDON journal which I have just received says that most of President Coolidge's message to Congress "simply made one's mouth water. It is a picture of a country in such a state of prosperity as the world has never known."

The Saturday Evening Post is running a series of articles entitled "The American Book of Wonder," which depicts the United States in a new era of ever-widening economic achievement and individual well-being, before which we are invited to stand in amazement.

An Australian mission to this country has published its observations on our industrial system, which include statements that "the whole country seems to be working intensively," that hand-to-mouth buying has made for efficiency and done much toward assuring stability of employment, and that there is a "new spirit in industry." Labor and capital, the report says, have each recognized that the other must have a satisfactory reward for its work, and each is genuinely interested in helping the other.

A dean of Cornell University said a few days ago that our enormous industrial production had put us, for the first time since the world began, in touch with the abolition of poverty. From every side we hear of the "stabilization" of business, of the ever-growing mastery of the technique of control of production and credit so that booms and depressions alike may be nipped at their beginning, and of new mechanical and scientific marvels whose ultimate purpose is the material and spiritual enrichment of mankind.

These observations seem particularly pertinent for the last week of the year, which can appropriately be devoted to retrospection before 1928 obtrudes itself. The picture of achievement that they present is attuned to the spirit of the holiday season, for if any are dissatisfied with the contraction of business that has marked the second half of 1927, they may well forget their discontent in the knowledge that recessions are but incidents in the onward movement of economic progress, and that they cannot equal the advances either in duration or magnitude.

Sam A. Lewisohn once said that the rise in the purchasing power of the American people commanded services which cannot be measured by statistics, but which might be called "psychic income." And most of us in 1927 must agree that our "psychic income" has never been greater, our progress toward the business millenium of stability and prosperity for all has not been checked, and the year has brought forth nothing that threatens the business of 1928 if we can immunize ourselves to the effects of a possible declining tendency in the price of securities. That should not be particularly difficult, for commerce and industry have already demonstrated their immunity to the advance in stocks, and refused to follow them along the road of inflation, and there is no reason except the psychological why they should not be equally insensitive to the decline if and when it comes.

1927 was foredoomed to be a year of business recession because it followed a year in which more business records were broken than in any other of our history. The recession was correctly prophesied by most economists and the caution that their outgivings generated undoubtedly kept it within moderate proportions. Conversely the prophets are now saying that 1928 will reverse the trend of 1927, and business will move gradually from a low to a higher level, and if they are as influential in generating courage as they were in creating caution we are already assured of a prosperous New Year.

The course of the automobile industry epitomizes both the history of the past year and the outlook for the next. Production has gradually declined until within the past two months it has dropped to a level which cannot be matched this side of 1921. In November the total output was only 133,000 cars and trucks, about one-third of normal. But the figures attracted very little attention because everyone seems to be convinced that a new high record for sales will be made next year.

In iron and steel the same expectancy that expansion will follow the contraction of the past quarter is evident. The output increased a little last week and the reviews tell of more numerous orders that assure a rising rate of production as the New Year grows older.

The most substantial improvement that occurred in 1927 is one whose full effects will not be felt until 1928—the increase in the value of agricultural production. On the basis of its final crop estimate and Dec. 1 farm prices, the Department of Agriculture estimates that the crops will yield $635,000,000 more than in 1926, and higher prices for meats and livestock will greatly increase that sum. Beef, in fact, has gone so high that murmurs of a boycott against it have been heard in some cities, impelling Secretary Jardine to announce that for the first time in years the livestock men are receiving remunerative prices and that the advance was vitally necessary to keep up the supply.

WHAT'S DOING IN INDUSTRY

LITTLE in the way of business improvement developed in the last week of the year. The holiday spirit has had its effect, and inventory and budget making also influenced the placing of orders for machine shop equipment. The feature of the present situation in this industry is the optimism of manufacturers and dealers over the outlook for the New Year. Certain fundamental economic conditions, together with definite industrial trends, lead to the general belief that 1928 will see considerable improvement in the machinery and machine tool trade.

DETROIT is one particular center where this improvement is expected to show the greatest progress. The automobile industry, both here and in Indianapolis and other midwestern sections, is known to be about ready to place orders for machine tools. General improvement and a livelier market is reported from Cincinnati. The trend in Chicago is desultory, with little feature except good prospect for 1928.

IN CANADA the steel and building industries are furnishing a remarkably stable volume of machinery business. New York is quite pleased with the unusual number of pre-inventory closings. A better tone is noted throughout New England and the outlook is quite promising. The Southern district reports a satisfactory volume for this season of the year.

The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

CANADA

Machinery and machine tool business in Canada is holding up remarkably well, and present indications point to a continuance of activity well into the first quarter of 1928. Manufacturers are contracting for supplies, and specifying against contracts in a manner not apparent a few weeks ago. Most metal-working plants are in good condition so far as orders are concerned.

Books of iron and steel producers are taking on a more healthy aspect, and sentiment is notably improved. The largest rail ever rolled in Canada, and the first to be turned out for an American concern by a Canadian steel mill will be produced by the Sydney plant of the British Empire Steel Corporation early in February, when work will be commended on the recently secured New York Central contract calling for 11,600 tons of steel rails for the Michigan Central lines.

One of the outstanding features of the business and industrial situation this year has been the construction industry. Building throughout the Dominion has now exceeded the final total for the entire year of 1926 by 2.8 per cent. The cumulative total for the eleven months was $382,269,600. A further feature of the construction situation is that contemplated new work totals $614,337,300.

INDIANAPOLIS

While there is no apparent improvement in demand here for machine tools and machinery, the outlook is very promising. The local trade, judging from inquiries received during the last two weeks, expects business to pick up immediately after the holiday season. For one thing, the automobile industry is assuming more activity in Indiana than for months. Such plants as Marmon, Chrysler at Newcastle, Stutz, and Studebaker at South Bend, are all increasing their production.

Demand for special machinery from the coal fields is only fair, as production at the various mines is below normal. Demand from the steel industry is slow. There are some indications of increased production and some inquiries are being received, but orders are scarce. A fair demand for small machinery is coming from garages.

Inquiries are being received for special woodworking machinery from furniture factories, most of which are increasing their output. The same is true of the farm implement factories. With the latter, the situation is said to be better than this time last year. Railroads are buying only for emergency purposes, though inquiries are numerous. Reports show most of the rail shops in the state are putting more men to work and are preparing for some increased activities after the first of the year.

CINCINNATI

As the year approaches its end, machine tool manufacturers in the Cincinnati district find that business conditions are improving in a way that gives much encouragement. Taking the reports of the industry of the district as a whole, the market is livening up considerably, and an increasing volume of business is coming in. Selling agents report an improvement in the demand and they regard the situation as encouraging.

While in the week there were received a number of orders that called for two or more tools, the majority of the orders booked in the period called for single tools. The week's sales were well diversified as to sizes and types of requirements and the orders were well distributed over the country. The principal buyers were general machinists and miscellaneous users, but a number of purchases were made by concerns in the automotive industry and in the electrical field.

Inquiries came in freely during the week, showing an increase over the previous week. The greater portion of these were in regard to single tools. While books have not been closed at this writing it is thought that the past month's sales will be considerably larger than anticipated.

WESTERN NEW ENGLAND

Despite a definite decline in orders placed in the machine tool and machinery market during the week, there is a better tone to the situation in this section. December has been a better month than the average, most manufacturers and dealers report. Figures have been sent out in substantial volume and manufacturers are looking forward to closing many of these contracts early in the New Year.

Improvement in the automotive industry has had a beneficial effect on conditions in the Western New England section. A Bridgeport dealer disposed of several small automatic machines to be used for the production of automobile hardware. The buyer has purchased a three-story unit which will require equipment, it is reported, after January first. Another prospective demand lists a milling machine, gear cutter, drill, a heavy-duty shaper and a smaller shaper, the two latter items for the railroad industry.

NEW YORK

The last week in December—and in 1927—brought little business other than the usual pre-inventory orders that had been hanging fire for some time. Jig borers, lathes of various sizes, radial drills, die sinkers and grinders were represented in the week's sales. Inquiries for immediate needs are negligible, but not unusual. Some fair sales of used tools were reported.

The month presented an unusual sales activity and many last-quarter sales quotas were benefited by the unexpected closing of old orders. Prospects for January business are good and dealers are optimistic.

DETROIT

December has been a profitable month for machinery dealers in the Detroit district. Accustomed as they are to a pre-holiday slump, the dealers were somewhat surprised to discover that their sales are higher than they have been in any recent month. One of the leading firms here reports more business in December than in any month of 1927. Another dealer reports the receipt of dozens of very good and substantial inquiries. Tool shops are busier than they have been and the whole atmosphere is healthy and progressive.

One of the principal reasons for this activity is the work of the Ford Motor Co. Not only are the Fords actually making heavy purchases of production machinery, but they are stimulating other large manufacturers of automobiles to improve and increase their equipment. Before the announcement of the new Ford was made, and for some time afterward, the company bought refinement machinery almost entirely. Now they are buying equipment to produce the new car, and the volume is expected to be large.

Dodge Brothers are showing a great deal of activity. They are buying equipment for the new light six which is soon due and they are also adding machinery for the production of the four. Paige is very active; Chevrolet is doing considerable buying as is Oakland and Studebaker.

CHICAGO

The last days of 1927 disclose no new features with respect to conditions in the machine tool market, which, as for some time past, are inactive. Dealers and manufacturers' representatives report business quiet. An occasional worth while sale is mentioned, but such sales are the exception to the rule. Inquiries being received have reference to consideration early next year, and mostly are of a tentative nature.

Dealers in used tools are hopefully expectant of a renewal of activity in their line before long, and anticipate a larger number of inquiries during the first months of 1928, basing their expectations on the forecasts of authorities on economics to the effect that there will be a general increase in manufacturing activity throughout the country before the new year is well advanced.

EASTERN NEW ENGLAND

According to leading houses in the Eastern New England section, business in machine tools shows little activity and proportionately few inquiries. Most houses do not expect business to pick up much before the middle of January, although a few are hopeful for quicker activity at the start of the year.

Machine shop supplies continue brisk. Volume for the week exceeds the average for last week, and one house reports an actual shortage of stock on hand. Small goods and shop furniture are in fair demand, orders being received direct from factories.

SOUTHERN DISTRICT

Considering the fact that this is usually a dull season, machinery and machine tool business has been satisfactory to the dealers in the Southeast in the past two or three weeks, with sales better than they were at this time last year, and inquiries giving every promise that there will be a steady improvement in sales during the early part of the coming year. Indications are, in fact, that sales for the first quarter of 1928 will be well in excess of sales for the first quarter of 1927, and that they will also hold up well during the second quarter.

Demand has declined considerably of late for woodworking machinery in the lumber and furniture fields. There is comparatively little demand for either contractors' or road building equipment.

Railroads are buying very little, but still placing a few orders for heavier equipment for use in some of the various shop construction projects under way in this district.

British Will Finance Textile Machinery Purchasing

The negotiations between British textile machinery manufacturers and the German textile industry for an extensive long-term credit financing scheme for assisting the German textile industry to buy more British textile machines has attracted much attention. Total purchases of $100,000,000, spread over the next ten years, at attractive interest rates, are contemplated. The final effect of the financing scheme will be an increase of British textile machinery sales to the German textile industry with a consequent loss of business for local German textile machinery manufacturers and a strengthening of the competitive position of small and medium sized textile manufacturing enterprises in Germany.

Competition from Within

The German textile industry originally depended almost entirely on British machines. Many years before the war, however, a strong domestic textile machinery industry had grown up in Germany and was giving increased competition to Great Britain. During the war and the inflation period, ending with 1923, few or no foreign textile machines were imported. The German textile machinery industry had in the meantime improved its products and had become able to capture the domestic sales and in addition to sell quite a large volume of machines abroad.

There are some types of textile machines in which Great Britain still predominates, especially cotton spinning machines for fine-count yarns, special types of knitting machines, as well as machines used in combing wool. Germany buys relatively few textile machines from countries other than Great Britain; a few specialized machines are supplied by France, Switzerland and the United States. In general, Great Britain supplies 80 per cent of German imports of textile machinery. In 1926 German textile machinery exported to foreign countries had a value of 154 million marks, compared with total imports of only 24 million marks. In the first months of 1927, however, British textile machinery producers have been able to increase their business in Germany, selling approximately 8 million marks worth of machinery in the first seven months of 1927, as compared with 6.2 million marks in the same period of 1926.

Dr. Degan, of Berlin, who is acting as secretary for several German textile associations, led the negotiations on behalf of the German textile industry. The plan calls for British credits to enable the German textile industry to buy the machines necessary for a thorough reorganization and to make their plants more efficient.

The new plan calls for financial assistance rendered direct to the textile industry by machinery producers, and only those firms who are willing to place their orders over a period of years with the syndicate of British machinery manufacturers will be able to participate in the credit scheme. The British group is headed by the General Trading and Finance Ltd. No fixed amount has been set for the total financing scheme, but it is estimated that total possible sales, under this agreement for a period of ten years, may be somewhere around £20,000,000.

The initial payment and interest rates will be determined in each individual case. As a general rule, the cash payment will amount to from 20 to 25 per cent and the balance will be credited for 3 or 4 years at 6½ to 8 per cent interest, depending upon the fluctuations of the discount rate. The interest rate, it is said, will depend to a very large extent upon the financial standing of the prospective customer.

Much greater significance may be attached to the reported plan of extending this credit scheme to other countries in Europe. Although no specific countries are mentioned, it can safely be assumed that the interest of the British companies backing this action lies mainly, if not exclusively, with Russia. Other European countries are also greatly interested in the British plan, and its possible extension to other European countries.

Six Airports Planned for New York

Plans calling for the utilization of 2,800 acres for the development of six first-class airports in the New York-New Jersey area, including one on Governors Island, were submitted by the Fact Finding Committee, selected from the two states at the request of Secretary Hoover of the Department of Commerce to study the flying field needs of the metropolitan area.

The recommendations were presented at a luncheon attended by 1,200 representatives of civic and commercial groups in the Hotel Astor on Dec. 20. William P. MacCracken, Jr., Assistant Secretary of Commerce for Aeronautics and chairman of the committee, was toastmaster.

The fact finding committee, after considering seventy-two suggestions, indorsed six sites for immediate development and four as second choice, on the basis of accessibility, size, shape, weather conditions, property values and the initial cost of development. Four of the first choices are in Greater New York, one in Newark and the other in the Hackensack Meadows. The areas include the Queens-Flushing Bay section, Newark Bay area, Bronx-East River area, Hackensack Meadow section, Jamaica Bay section and the Wall Street-Brooklyn district.

Mr. MacCracken said he had visited recently more than half of the states of the Union and that the question in all localities, after local needs had been considered, was what action New York City would take to meet the airport requirements.

Slow Progress Made in Elimination of Trade Barriers

European countries have not made a great deal of progress in carrying out the recommendations for the elimination of trade barriers as proposed by the Geneva and Stockholm economic conferences, says a statement from the Paris headquarters of the International Chamber of Commerce.

The surface reactions from the two conferences, which were attended by world business leaders, have been violent and discouraging at first glance. "However," the statement says, "too few seem to note the fact that governments are now beginning either to apologize or to protest, as the case may be, whenever they diverge, or are faced with divergencies from the sane and peaceful decisions of these two remarkable expressions of opinion based on the authority of practical experience."

French Tariff Less Liberal

France is not the only country which seems to have fallen short of the advanced opinion of her leading business men. It is evident that, as yet, countries differ as to the type as much as to the character of the policy they desire to pursue. France has a tariff system which, in so far as it is protective, does not radically differ from the American tariff system. In principle, the French tariff may be regarded in certain lights, as less liberal than our own. What no one abroad seems to appreciate fully is one of the impartial factors in the American interpretation of ad valorem duties. The American Tariff Commission is prepared to hear complaints from foreign producers to lower tariff rates, if the foreign complainant cares to undertake proof that the American tariff duty on a given article is so high that it more than equalizes the cost of production.

Although attention centers on France, other countries have latent political difficulties. At the diplomatic conference at Geneva on export and import prohibitions, the British delegation frankly admitted that they could not promise that their law excluding all dyestuffs from importation into Great Britain (which expires in 1930) might not be extended.

Tariff Prohibitions Checked

While the diplomatic conference at Geneva failed to realize its purpose in complete form, it has torn aside the veil of reticence which obscured a good many vital policies and the dormant difficulties which lay behind them have been given a fuller ventilation than ever before. The strangling system of import and export prohibitions which has developed almost unchecked during the economic dislocation of the last few years, has at last been tagged, named, defined, restricted in some important phases, and finally has been condemned to continued examination in the slow progress of government policy.

Personals

HENRY FORD has retired as president of the Ford Motor Co. of Canada, Ltd., and has been succeeded by his son Edsel.

C. E. BUDD has been appointed purchasing agent for the Bendix Brake Co., of South Bend, Ind.

V. D. OVERMAN has resigned as production superintendent of the Lincoln Division of the Ford Motor Co.

WILLIAM HUNTER has been appointed acting manager of the Philadelphia office of the Niles-Bement-Pond Co.

HARRY BILLS has been appointed service manager of the Ford Motor Co. He succeeds E. P. Hobart, who resigned.

GEORGE W. SMITH has been appointed works manager of the White Motor Co. He was formerly technical assistant to the vice-president.

H. F. WOLNICK has joined the sales force of the Hendey Machine Co. in Chicago. He is located at the company's office at 555 W. Washington Blvd.

DEAN DEXTER S. KIMBALL, of Cornell University, has been appointed by Secretary of Commerce Herbert Hoover to be a permanent member of the committee of the World's Congress of Engineers.

JAMES H. SLAWSON has been elected president and general manager of Western Malleables, Inc., Beaver Dam, Wis. He was formerly president of the Chicago Malleable Castings Co.

JAMES C. BENNET, comptroller and secretary of the Westinghouse Electric and Manufacturing Co., has been elected a vice-president of the company. He will have general charge of the accounting and treasury departments.

K. H. CONDIT, editor of the *American Machinist*, who has served for four years on the Publications Committee of the American Society of Mechanical Engineers, has been elected chairman of the committee for the ensuing year.

HAROLD F. WELCH, who has been sales manager of the Niles Tool Works Division of the Niles-Bement-Pond Co., has been appointed sales manager of the New York territory of the Niles-Bement-Pond Co. and its divisions. He will also act as advisor to the president on sales matters.

L. C. MORROW, managing editor of the *American Machinist*, has been re-elected chairman of the Machine Shop Practice Division of the American Society of Mechanical Engineers. The year 1928 will be Mr. Morrow's third of service as a member of the executive committee and second as chairman of the division.

Business Items

Walter B. Snow and Staff, Inc., advertising agents, announce the removal of their offices to the Statler Bldg., in Boston, Mass.

The Simmons Machine Tool Co., of Albany, has purchased the plant of the General Railway Signal Co., at Albany. The Simmons company will use the buildings, which adjoin its present plant, for expansion of facilities.

Articles of incorporation have been filed with the secretary of state in Indianapolis by the Marion Craftsman Tool Co., of Marion, Ind. The company will manufacture tools and other metal products. The incorporators are Otto E. Draudt, Newell H. Motsinger, and Oscar S. Thompson.

Articles of incorporation have been filed with the secretary of state in Indianapolis by the Hittle Machine and Tool Co., of Indianapolis. The corporation was formed to manufacture, sell and deal in tools, dies, machinery and other specialties. The incorporators are James Arthur Hittle, Edward Hermann and Laurel E. Wallace.

The new machine shop of the Western Gas Construction Co., at Fort Wayne, Ind., which has been under construction for several months, has been completed and all the machinery removed from the old shop into new quarters. The new storeroom of the company also is completed. The forge shop is about ready for operation.

The Chevrolet Motor Co. has purchased the iron foundry of the Saginaw Products Co., at Saginaw, Mich. The plant will handle a great amount of the foundry work of the Chevrolet production. It is equipped with modern material handling devices and is said to have a capacity of 800 tons of metal daily.

The Wilson Welder and Metals Co., Inc., of Hoboken, N. J., announces the appointment of the following representatives for its line of welding machines: Joseph T. Ryerson & Son, Inc., with offices at Chicago, Jersey City, Buffalo, Pittsburgh, Cleveland, Detroit, Cincinnati, St. Louis, Houston and Boston; Oliver H. Van Horn Co., Inc., New Orleans; Smith, Booth, Usher Co., Los Angeles and San Francisco.

The Moline Manufacturing Co., of Moline, Ill., has purchased the assets of the E. H. Wilson Manufacturing Co., also of Moline. The former company will continue the manufacture of automobile bodies, metal stampings and mechanical rubber goods. The officers of the new corporation are: R. G. Cundy, president; James P. Pearson, vice-president; W. L. Mueller, vice-president and treasurer.

The Malleable Iron Works of New Britain, Conn., has announced plans for equipment improvements. Installations of machinery will include equipment to eliminate the difficult labor. A proposed melting system will provide a coal stoking and pulverizing arrangement. A continuous annealing oven will be equipped with conveying machinery to carry castings through several stages of heat, and a system will be installed to cool the casting before removal. About $200,000 will be spent.

Standardization of airplane engines is anticipated through the incorporation of the Canadian Wright Co., Ltd., which has the sole right to assemble or manufacture the Wright whirlwind aero-engine for Canada and Australia, production of which will commence shortly in Montreal. Officials of the Canadian Vickers, Ltd., certain directors of which are associated with the new firm, have announced that the engine will be assembled in Montreal, and that between 10 and 15 motors will be on the market by the end of March.

The Super Oil Heater Co., Hartford, Conn., is to move its manufacturing plant to the plant of the Potter & Johnston Machinery Co., at Pawtucket, R. I. Officials of the latter company have secured a substantial interest in the concern, which manufactures oil heating apparatus. Officers of the Super Oil Heater Co. have been elected as follows: David B. Roberts, president; John Johnston, vice-president; W. Wallace Potter, treasurer; Earl H. Roberts, secretary. Sales offices will be maintained at Hartford in charge of Harry Roberts.

An arrangement has just been completed between the Massey-Harris Co., Ltd., of Toronto, and Sawyer-Massey, Ltd., of Hamilton, Ontario, whereby the Massey Harris Co., Ltd., undertakes the sole distribution of threshers and thresher equipment manufactured by Sawyer-Massey, Ltd. The Massey-Harris company will add to its present line the Sawyer-Massey thresher which will be made exclusively for it. The machines will be built at the Sawyer-Massey plant in Hamilton as in the past. This contract does not apply in any way to the Sawyer-Massey line of road machinery and contractor's equipment.

Obituaries

V. K. SPICER, Western manager of the Union Switch and Signal Co., died at his home in Kenilworth, Ill., on Dec. 7.

SENTER M. JONES, first vice-president of the Century Electric Co., of St. Louis, died suddenly on Dec. 11 at his home in that city. He was a member of the American Institute of Electrical Engineers.

COL. GRANT GREEN, head of the visitor's bureau of the Westinghouse Electric and Manufacturing Co., died in Wilkinsburg on Nov. 24.

GEORGE V. SHEPARD, assistant division manager at the Meriden, Conn., plant of the New Departure Manufacturing Co., died on Dec. 18 at his home in that city. He had been assistant manager at the Meriden plant since 1920 and previously was plant engineer at the Elmwood factory of the company.

HARVEY HUBBELL, president of Harvey Hubbell, Inc., Bridgeport, Conn., manufacturer of numerous electrical devices, died on Dec. 17 at his home in that city. Mr. Hubbell was famous for his inventive mind, having produced about 3,000 mechanical devices. He invented the automatic screw machine which has been used for many years in the production of machine screws.

Forthcoming Meetings

National Safety Council. Rhode Island Industrial Safety Conference, Biltmore Hotel, Providence, R. I., Jan. 17. A. A. Mowbray, secretary, 108 East Ohio St., Chicago.

Society of Automotive Engineers. Annual meeting, Book-Cadillac Hotel, Detroit, Mich., Jan. 24 to 27. C. E. Heywood, in charge of meetings, 29 West 39th St., New York City.

Foundry Equipment Manufacturers' Association. Annual meeting, Feb. 7, 1928, Cleveland Hotel, Cleveland, Ohio. H. Cole Estep, secretary, 1213 Third St., Cleveland.

American Society for Steel Treating. Semi-annual meeting, Montreal, Canada, Feb. 16 and 17, 1928. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland.

American Gear Manufacturers' Association. Twelfth annual meeting, Rochester, N. Y., April. Details later. T. W. Owen, secretary, 3608 Euclid Ave., Cleveland, Ohio.

American Welding Society. Annual meeting, week of April 23, New York City. M. M. Kelly, secretary, 33 West 39th Street, New York City.

American Railway Association. Schedule of sectional meetings: Division IV, Engineering, March 6 to 8, Chicago Division V, Mechanical, June 13 to 20, Atlantic City, N. J.; Division VI, Purchases and Stores, June 13 to 15, Atlantic City, N. J.

National Metal Trades Association. Thirtieth annual meeting, Hotel Astor, New York, April 25 and 26. J. E. Nyham, secretary, Peoples Gas Bldg., Chicago, Ill.

National Foreign Trade Council. Fifteenth anniversary convention, Houston, Texas, April 25, 26 and 27. O. K. Davis, secretary, India House, Hanover Square, New York.

National Association of Purchasing Agents. Annual meeting and "Informashow," Kansas City, Mo., May 28 to 31. W. L. Chandler, secretary, 11 Park Place, New York.

Association of Iron and Steel Electrical Engineers. Annual meeting, Stevens Hotel, Chicago, June 25 to 29. J. F. Kelly, managing director, Empire Bldg., Pittsburgh, Pa.

American Society for Testing Materials. Annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., June 25 to 29. C. L. Warwick, secretary, 1315 Spruce St., Philadelphia, Pa.

American Railway Tool Foremen's Association. Annual meeting, Hotel Sherman, Chicago, Aug. 29 to 31. G. G. Macina, secretary, 11402 Calumet Ave., Chicago.

American Railway Tool Foreman's Association. Sixteenth annual convention of the Supply Association, Hotel Sherman, Chicago, Aug. 29 to 31. F. A. Armstrong, secretary, the Pratt & Whitney Co., 564 W. Monroe St., Chicago.

American Society for Steel Treating. "National Metals Exposition," Commercial Museum, Philadelphia, Pa., week of Oct. 8. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

The Weekly Price Guide

Rise and Fall of the Market

BUYING for current requirements is most active in steel bars, strip steel, lap-weld pipe, light rails, plates and other railway material. Steel prices, however, remain unchanged, compared with those of a week ago, with the exception of black and blue-annealed sheets. The latter declined 5 to 10c. per 100 lb. at Pittsburgh mills. Principal price advances of the week occurred in copper wire, fabricated brass and copper, zinc sheets, and flint paper. Weakness prevails in pig iron. Steel bars, shapes, and plates hold firmly to the price of $1.80 per 100 lb., base, Pittsburgh, for carload lots or over.

(*All prices as of Dec. 23*)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$21.44
Northern Basic	20.89
Southern Ohio No. 2	21.19
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	25.62
BIRMINGHAM	
No. 2 Foundry	16.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	21.76
Virginia No. 2	27.17
Basic	21.26
CHICAGO	
No. 2 Foundry local (silicon 1.75@2.25)	20.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	22.80
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	20.26
Basic	19.26
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.50@4.75
Cleveland	5.00
Cincinnati	4.30
New York	5.25
Chicago	4.50@4.75

SHEETS—Quotations are in cents per pound in various cities rom warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.05@2.15	3.50	3.25	3.89
No. 12	2.10@2.20	3.55	3.30	3.94
No. 14	2.15@2.25	3.60	3.35	3.99
No. 16	2.25@2.35	3.70	3.45	4.09
Black				
Nos. 18 to 20	2.50@2.60	3.75	3.55	4.00
No. 22	2.65@2.75	3.90	3.70	4.15
No. 24	2.70@2.80	3.95	3.75	4.20
No. 26	2.80@2.90	4.05	3.85	4.30
No. 28	2.95@3.15	4.20	4.00	4.45
Galvanized				
No. 10	2.90@2.95	4.10	3.80	4.25
Nos. 12 to 14	3.00@3.05	4.20	3.90	4.35
No. 16	3.10@3.15	4.30	4.00	4.45
No. 18	3.25@3.30	4.45	4.15	4.60
No. 20	3.40@3.45	4.60	4.35	4.75
No. 22	3.45@3.50	4.65	4.40	4.80
No. 24	3.60@3.65	4.80	4.50	4.95
No. 26	3.85@3.90	5.05	4.75	5.20
No. 28	4.10@4.15	5.30	5.00	5.45

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	54%	41%
2½ to 6 in. steel lap welded	48%	35%	53½%	40½%	51%	38%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36-5% off.

Size, Inches	List Price per Foot	Diameter in Inches — External	Diameter in Inches — Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to.30 carbon, at warehouse in lots of less than 100 ft. or 100 lb.:

Thickness — Decimal	B.w.g. and Fractions	Outside Diameter in Inches — ¼	⅜	½	⅝	1	1¼	1½
		Price per Foot						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
.065"	16	.19	.20	.21	.22	.23	.25	.27
.083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse base prices in cents per lb.:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	....	4.65
Spring steel, heavier	4.00	....	4.00
Coppered Bessemer rods	6.05	6.00	6.20
Hoop steel	4.49	3.65	4.15
Cold rolled strip steel	6.25	5.70	6.10
Floor plates	5.25	5.30	5.00
Cold drawn, round and hex.†	4.00	3.65	3.60
Cold drawn, flats and squares	4.50	4.15	4.10
Structural shapes	3.34	3.00	3.10
Soft steel bars	3.24	3.00	3.00
Soft steel bar shapes	3.24	3.00	3.00
Soft steel bands	3.99	3.65	3.65
Tank plates	3.34	3.00	3.10
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, ⅛", 8.35c.; ¼, 7.85c.; 5/32 to ½, 7.35c. per lb.*Flat, ⅛@¼-in. thick. †also shafting and screw stock.

METALS

Current Warehouse Prices in Cents Per Pound for Small Lots

Copper, electrolytic, up to carlots, New York			15.37½
Tin, pigs, 5-ton lots, New York			60.12½
Lead, pigs, up to carlots, E. St. Louis	6.30	New York	7.12½
Zinc, slabs, up to carlots, E. St. Louis	5.62½	New York	6.50

	New York	Cleveland	Chicago
Antimony, slabs, ton spot	13.50	14.00	14.25
Copper sheets, base	22.75	22.75	22.75
Copper wire, base	19.37½	19.25	15½@15¾*
Copper bars, base	22.25	22.25	22.25
Copper tubing, base	24.50	24.75	24.50
Brass sheets, high, base	18.75	18.75	18.75
Brass tubing, high, base	23.62½	23.62½	23.62½
Brass rods, high, base	16.50	16.50	16.50
Brass wire, high, base	19.25	19.50	19.25

*Mill

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1 to 15 ton lots	24.30	26@27	26.02
Zinc sheets (casks)	11.00	12.65	10 36
Solder (½ and ½), (case lots)	36.75	37.50	34@38

Babbitt metal, delivered, New York, cents per lb.:

Genuine, highest grade	76.00
Commercial genuine, intermediate grade	61.00
Anti-friction metal, general service	31.50
No. 4 babbitt (f.o.b.)	12.50

Nickel, f.o.b. refinery, cents per lb.:

Ingots	35.00	Electrolytic	37.00
Shot			36.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Full finished nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	45.00
Cold drawn rods, Grade "A" (base)	53.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	28.00	Hot rolled rods (base)	35.00
Blocks	32.00	Cold drawn rods (base)	43.00
Cold rolled sheets (base)	50.00	Full finished sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible copper	12.25 @12.50	11.00	11.00@11.50
Copper, heavy, and wire	11.50 @12.25	10 75	10.25@10 75
Copper, light, and bottoms	10 00 @10.50	9.50	9.25@ 9 75
Heavy lead	5 25 @ 5.50	5.25	4.75@ 5.25
Tea lead	4.25 @ 4.50	3.75	4.00@ 4.50
Brass, heavy, yellow	7 25 @ 7.50	7.25	7.00@ 7.50
Brass, heavy, red	9.00 @ 9 50	9.75	9.00@ 9 50
Brass, light	5 50 @ 5.75	5.75	6.00@ 6 50
No. 1 yellow rod turnings	7.50 @ 8.00	7.50	7.00@ 7.50
Zinc	3.37½@ 3.62½	3.25	2.50@ 3.00

TIN PLATES—Charcoal—Bright—Per box

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20	9.70	9.90	9 50
Coke Plates—Primes—Per box				
100-lb.,	14x20	6.45	6.10	7.00
Terne Plates—Small lots, 8-lb. Coating—Per box				
IC,	14x20	7.75@8.00	7.00	7 50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0. 10@0. 13½	$0.16	$0.15@0.20
Cotton waste, colored, per lb.	.09@ .13	.12	.12@.17
Wiping cloths, washed white, per lb	15½@17½	36.00 per M	.15
Sal soda, per lb	.03¾	02	.02¾
Roll sulphur, per lb	02⁷	03½	04
Linseed oil, raw, per 7½-lb. gal., 5 bbl. lots	79½	.89	76
Lard cutting oil, 25% lard, in 5 gal. cans, per gal.	.65	.50	.50
Machine oil, medium-bodied (55 gal. steel bbl.) per gal.	.27	.35	.26
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft per inch of width for single ply.			
Medium grade	35%	35%	35%
Heavy grade	30%	30%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50%	50–10%	50%*
Second grade	50–10%	60–5%	50–10%†

*Large quantities, 60%. †Large quantities, 60-10%

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb	$0.0324	$0.0324	$0.0324
Cold drawn shafting	per lb	.04	.04	.04
Brass rods	per lb	.16½	.16	.1637½
Solder (½ and ½)	per lb	.36¾	.35¾	.42
Cotton waste, white	per lb	.10@13½	10@.13½	.13@.17½
Emery disks, cloth, No. 1, 6 in. dia.	per 100	3.10	3.10	3.10
Lard cutting oil	per gal.	.65	.65	.55
Machine oil	per gal.	.27	.27	.35
Belting, leather, medium	off list	35%	35%	40–5%
Machine bolts, up to 1x30 in., full kegs	off list	50%*	50%*	40%

*New list April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
*Flint paper	$5.40	$4.95	$5.13
*Emery paper	10. 71	9. 15	10. 71
*Emery cloth	27.84	27. 85	27. 84
Emery disks, 6 in. dia., No. 1, per 100:			
Paper	1 29	1. 27	1. 32
Cloth	3.10	3.05	3.05
Fire clay, per 100 lb. bag		.75	.75
Coke, prompt furnace, per net ton		Connellsville, 2.65@3.00	
Coke, prompt foundry, per net ton		Connellsville, 3.75@4.50	
White lead, dry or in oil,	100 lb. kegs	New York, 13.75	
Red lead, dry,	100 lb. kegs	New York, 13.75	
Red lead, in oil,	100 lb. kegs	New York, 15 25	

*4½ reams and under.

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

	Full Kegs or Cases
Machine bolts, square heads and nuts:	
Up to ¾ x 6-in	55%
Larger up to 1 x 30-in	50%
1½ and 1¼ in. dia	35%
Carriage bolts:	
Up to ½ x 6-in	55%
Larger sizes	50%
Coach and lag screws:	
Up to ½ x 6-in	55%
Larger sizes	50%
Tap bolts, hexagonal heads	40%
Nuts:	
Hot pressed, square and hexagonal, blank or tapped, up to 1-in., incl	55%
Cold punched, square and hexagonal, blank or tapped, up to 1-in, incl	55%
Semi-finished, hexagonal, tapped, in packages, all sizes	40%
Case hardened, hexagonal, tapped, in packages, all sizes	30%
Washers: Deduct from list, per 100 lb	$3.50*
Rivets, button and cone head:	
Small, including ½-in. dia	50–10%
Large (base) per 100 lb. net	$5.00†

Note—For less than case or keg quantities on bolts, screws, hot-pressed and cold-punched nuts, add extra of 10 per cent to list.

*Broken keg lots $1.50 off list. †Broken keg lots, $6 50 net.

Machine Requirements and Industrial Construction

Equipment Wanted

Ala., Mobile—W. Sibert, Engr., will receive bids until Jan. 4 for a 75 ton stationary crane for Pier 3 in Place, for Alabama State Docks Comn.

Conn., New Britain — Malleable Iron Works, G. E. Bean, Pres., Grove and Myrtle Sts.—equipment including annealing and cooling conveying machinery and oven equipment, coal stoking and pulverizing machinery, etc., for proposed hot mill. Estimated cost $200,000.

O., Springfield—Everwear Mfg. Co. (playground equipment)—machinery and equipment for proposed 1 story 50 x 50 ft. factory.

O., Springfield—Steel Products Engineering Co., I. W. Clark, Secy.—gear cutting machinery for proposed 1 story factory at Columbia and S. Dakota Sts., to cost $25,000.

Ore., Oregon City—Roake & Sons, J. A. Roake—machinery and equipment for proposed 2 story, 48 x 65 ft. foundry and machine shop.

Ont., St. Marys — St. Marys Wood Specialty Co., W. James, Mgr.—additional woodworking machinery for the manufacture of hockey sticks and wood specialties.

Opportunities for Future Business

Ala., Birmingham — Long-Lewis Hardward Co., Bessemer, plans the construction of a 2 story, 140 x 200 ft. factory, here. Estimated cost $150,000. Denham, Vankeuren & Denman, Age-Herald Bldg., Archts.

Calif., Burbank—General Water Heater Corp., 1601 Compton Ave., Los Angeles, plans the construction of a factory on Burbank St. here. Estimated cost $40,000. Architect not selected.

Calif., Huntington Park—W. P. Y. Air Compressor Co., plans the construction of a 40 x 150 ft. factory. Estimated cost including equipment $32,000.

Calif., Long Beach—City is having plans prepared for the construction of a machine shop, filling station, etc., in connection with municipal airport. Private plans.

Calif., Los Angeles — Brunswick-Balke-Collendar Co., 84 South Los Angeles St., is having plans prepared for a 177 x 400 ft. factory for the manufacture of billiard tables at Mines Ave. and Galada St. Estimated cost $300,000. J. T. Payne, 426 Western Mutual Life Bldg., and G. W. Harding, San Diego, Assoc. Archts. Noted Nov. 24.

Calif., Los Angeles — Firestone Tire & Rubber Co., 1165 South Figroa St., is having plans prepared for a 1 and 2 story service building on 8th St. Estimated cost $150,000. Curlett & Beelman, Union Bank Bldg., are architects.

Calif., Torrance — Dohney-Stone Drill Corp., c/o C. L. Peck, H. W. Heliman Bldg. Los Angeles, Contr., awarded contract for a 1 story, 180 x 360 ft. factory. Estimated cost $100,000.

Colo., Pueblo—Mettalloid Corp., Chicago, Ill., plans the construction of a 1 and 2 story, 80 x 100 ft. ore grinding plant on West Third St., here. Estimated cost $50,000.

Ill., Chicago—Edward Hines Lumber Co., Blue Island Ave. and Lincoln St., plans to rebuild portion of mill recently destroyed by fire. Loss is estimated at $350,000.

Ill., Chicago—A. O'Rourke Co., 111 West Washington St., had plans prepared for a 1 story addition to garage at 6132 Cottage Grove Ave. Estimated cost $75,000. Leichenke & Esser, 38 South Dearborn St., Archts.

Ill., Chicago—Schafer & Klooster, c/o Central Improvement Co., 111 West Washington St., plans the construction of a 1 story garage at 69th St. and Yale St. Estimated cost $75,000. M. O. Nathan, 123 West Madison Ave., Archt.

Ill., Chicago — R. Woodby, 1642 East 55th St., awarded contract for a 3 story, 146 x 301 ft. garage at 5610 Stony Island Ave. Estimated cost $350,000.

What This Section Is

Machinery Requirements and Industrial Construction is a reliable machinery market, because every item is reported first-hand by our own correspondents, scattered over the United States and Canada. These leads are verified by our men. We do not use newspaper clippings, nor do we listen to any hearsay or rumors. These sales leads are as accurate as our men can make them, and as timely as weekly publication will permit.

This market is for *American Machinist* subscribers. It covers the same machinery fields as does the paper. Here will be found inquiries for machine tools, presses, hammers, welding, forging and heat treating equipment, and other machinery for the shop.

Here also will be found reports of proposed industrial construction, where sooner or later machinery will be needed.

Are you making the most of the opportunities listed here?

Ill., East St. Louis—B. A. Mueller, Arcade Bldg., Archt., will soon receive bids for a 1 story garage at Third St. and Missouri Ave. Estimated cost including equipment $55,000. Owner's name withheld.

Ind., Anderson — General Motors Corp., General Motors Bldg., Detroit, Mich., plans the construction of a new foundry and assembly plant here.

Ind., Evansville—International Steel & Iron Co., Cleveland and Edgar Sts., awarded contract for a 1 story, 90 x 600 ft. factory. Estimated cost $45,000. Private plans.

Ind., Indianapolis—Embassy Realty Co., 540 North Meridian St., awarded contract for a 3 story, 90 x 140 ft. garage at Pennsylvania and 30th Sts. Estimated cost $150,000. Noted Dec. 22.

Mass., Dorchester (Boston P. O.) — J. Barnerin, 321 Norfolk St., will build a 1 story, 75 x 130 ft. garage and repair shop on East Cottage St. Estimated cost $40,000. F. A. Norcross, 46 Cornhill, Boston, Archt.

Mass., Worcester—Demers Bros. Co., 91 Grafton St., is receiving bids for a 1 story, 100 x 100 ft. repair and service garage at Green and Grafton Sts. Estimated cost $50,000. J. Rustigian, 16 Norwich St., Archt. Noted Dec. 22.

Mich., Grand Rapids—Linde Air Products Co., 30 East 42nd St., New York, N. Y., awarded contract for a 1 and 2 story, 46 x 96 ft. factory for welding equipment on Canton St. here. Estimated cost $50,000. Noted Dec. 15.

Mo., Kansas City—Standard Brass Mfg. Co., A. Nole, Pres., 13th and Chestnut Sts., manufacturers of brass, bronze and aluminum castings, will build a 1 story, 10 x 128 ft. factory. Private plans.

N. J., East Orange—Bd. of Education, 19 Winans St., awarded contract for a 3 story mechanical and wood-working shop. Estimated cost $85,000.

N. J., East Orange—Lock Joint Pipe Co., 150 Rutledge Ae., will build a 2 story, 40 x 300 ft. factory for the manufacture of steel pipe moulds. Estimated cost $40,000. Private plans.

N. Y., Buffalo—General Drop Forge Co., 1728 Elmwood Ave., is having plans prepared for a 1 story machine shop. Estimated cost $50,000. E. McGeorge, 3030 Euclid Ave., Cleveland Ave., Archt. and Engr.

N. Y., New York—Hermstar Realty Co., 60 West 190th St., had plans prepared for a 2 story, 100 x 195 ft. garage at Jerome Ave. and 184th St. Estimated cost $200,000. Maisner & Uffner, 4197 Park Ave., Archts.

O., Springfield—Everwear Mfg. Co., manufacturers of playground equipment, plans the construction of a 1 story, 50 x 50 ft. factory on Sycamore St. Estimated cost $40,000.

O., Springfield—Thompson Grinder Co. will soon receive bids for a 1 story, 30 x 60 ft. addition to factory at Tishler and Main Sts. Esitmated cost $40,000. Lloyd Teeler, Archt.

Ore., Oregon City—Roake & Sons, J. A. Roake, will receive bids about Jan. 15 for the construction of a 2 story, 48 x 65 ft. foundry and machine shop at Pacific Highway and South End Rd. Estimated cost $40,000 to $50,000.

R. I., Providence — Brier Mfg. Co., 70 Ship St., manufacturers of jewelry, awarded contract for a 3 story factory. Estimated cost $75,000. Noted Dec. 15.

Tenn., Memphis—Bd. of Education, Goodwyn Institute Bldg., will receive bids until Dec. 30 for a 3 story, 275 x 300 ft. technical high school including vocational shop, etc. Estimated cost $300,000. Hanker & Cairns, Court Square Bldg., Archts. Gardner & Howe, Porter Bldg., Engrs.

Tex., El Paso—Phelps-Dodge Corp., 90 John St., New York, N. Y., plans the construction of a copper refining plant here. Estimated cost $3,000,000. Private plans.

Wash., Seattle — City had preliminary plans prepared for the construction of a new 7 story, 120 x 180 ft. King County jail including garage, etc. Estimated cost $806,000. J. E. Blackwell, 1112 Harvard St. N., Archt.

Wis., Rhinelander—Wisconsin Veneer Co., plans the reconstruction of saw and veneer mills recently destroyed by fire.

Ont., Toronto—A. D. Garrie & Co., 354 Victoria St., awarded contract for a 3 story, 150 x 150 ft. garage on Gerrard St. E. Estimated cost $200,000.

American Machinist

KENNETH H. CONDIT and FRED H. COLVIN, *Editors*
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Wishing You an Active and Prosperous New Year

EVERY red-blooded American loves a good scrap. If signs mean anything he is going to be in for just that during the year ahead of us, for everything points to keener, more able and more relentless competition in every line of business activity. Orders promise to be plentiful but they will only be taken profitably by companies that are well-equipped and ably directed.

May you be numbered among those whose enterprise and progressive methods will bring profit to their activity.

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"Adaptability"

Most builders of wooden ships wouldn't change to iron ships—and their shipyards rotted.

Most makers of buggies couldn't grasp the idea of the automobile—and their plants have disappeared.

Many a shop, of many a kind is doomed to go the same way because its executives cannot see the necessity of replacing obsolete equipment with modern

Machine Tools—
The Master Tools of Industry

Modern Equipment
Increases Profits

NATIONAL
MACHINE TOOL BUILDERS'
ASSOCIATION

THE JOHNSON FRICTION CLUTCH

as used on the new Light Duplex

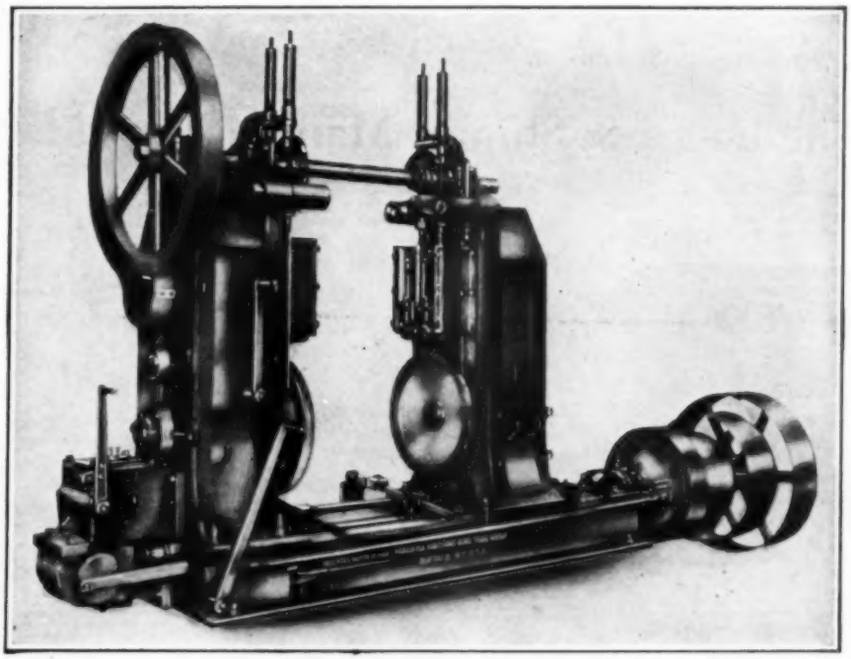
No. 309 Niagara Horizontal Double-End Seamer

No. 5 JOHNSON Single Clutch, on the main drive shaft in the left hand column.

The No. 5 Single Clutch is installed in the left hand column for operating the cam shaft.

The No. 4 Double Clutch in Gear Box at left of machine operates the mechanism for moving the right hand column right to left and left to right.

No. 4 JOHNSON Double Clutch as used in the gear box.



Courtesy Niagara Machine & Tool Works, Buffalo, N. Y.

On this Seamer the motion of the right hand column that clamps the drum and the motion of the roll cams are controlled by JOHNSON Clutches. Compact, powerful, rugged clutches.

A satisfied clutch customer back for more! JOHNSONS on their former Duplex Seamer, and on their Flanging Machine — and now on their new Seamer. What further proof is needed? Equip with JOHNSONS.

Write for Blue Catalog

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN

You can do it better—
on a Lodge &

Why?

In the first place it is ***easy to operate.*** Simplicity of design has been carefully adhered to. ***It is accurate.*** Accuracy is ***built in*** Lodge & Shipley Lathes. The workmanship and materials that enter into their construction are the best. After 33 years' specialization at building lathes the selection of materials is far past the experimental stage.

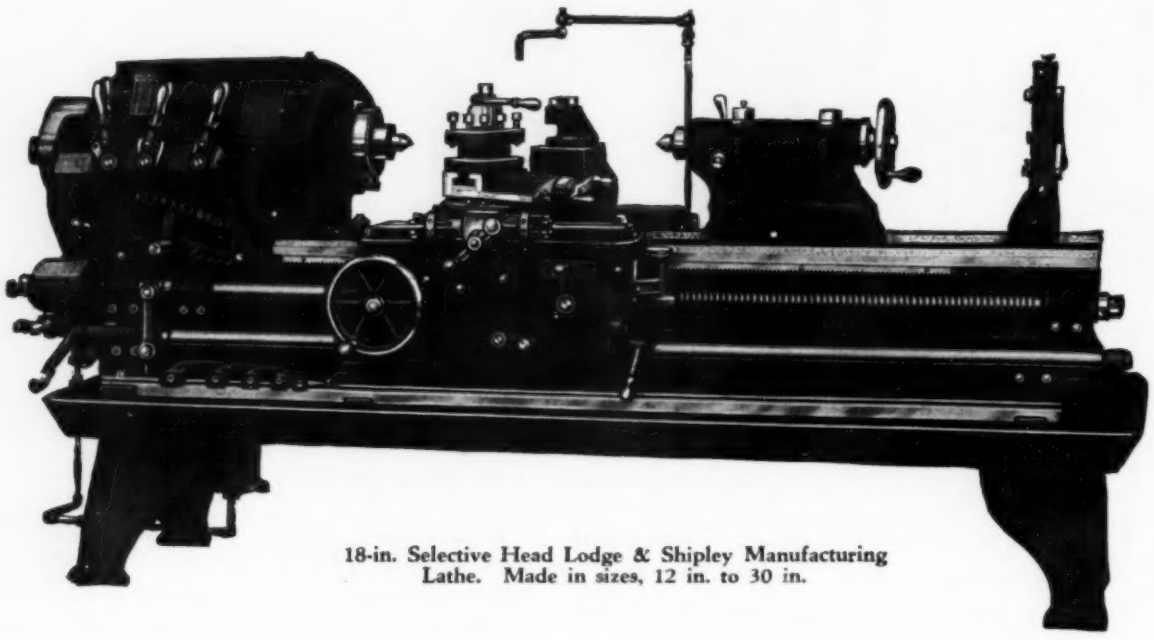
The design is such as to enable you to get the maximum amount of work in a given time.

Above all, the thing that makes the Lodge & Shipley Lathe stand out conspicuously as the Lathe of Lathes is its long life. The high quality materials and expert workmanship that are put into this machine give it sufficient ***stamina*** to maintain alignment and keep its accuracy years after the average lathe has been discarded.

The foregoing are a few of the vital reasons why you can ***do it better*** on a Lodge & Shipley!

Send for literature today on

The Lodge & Shipley Manufacturing Lathe



18-in. Selective Head Lodge & Shipley Manufacturing Lathe. Made in sizes, 12 in. to 30 in.

The Lodge & Shipley
Cincinnati,

& Shipley Lathe!

A lathe that possesses simplicity of design, accuracy and long life is an asset to any shop. Such a lathe is an investment and will pay you worth while dividends.

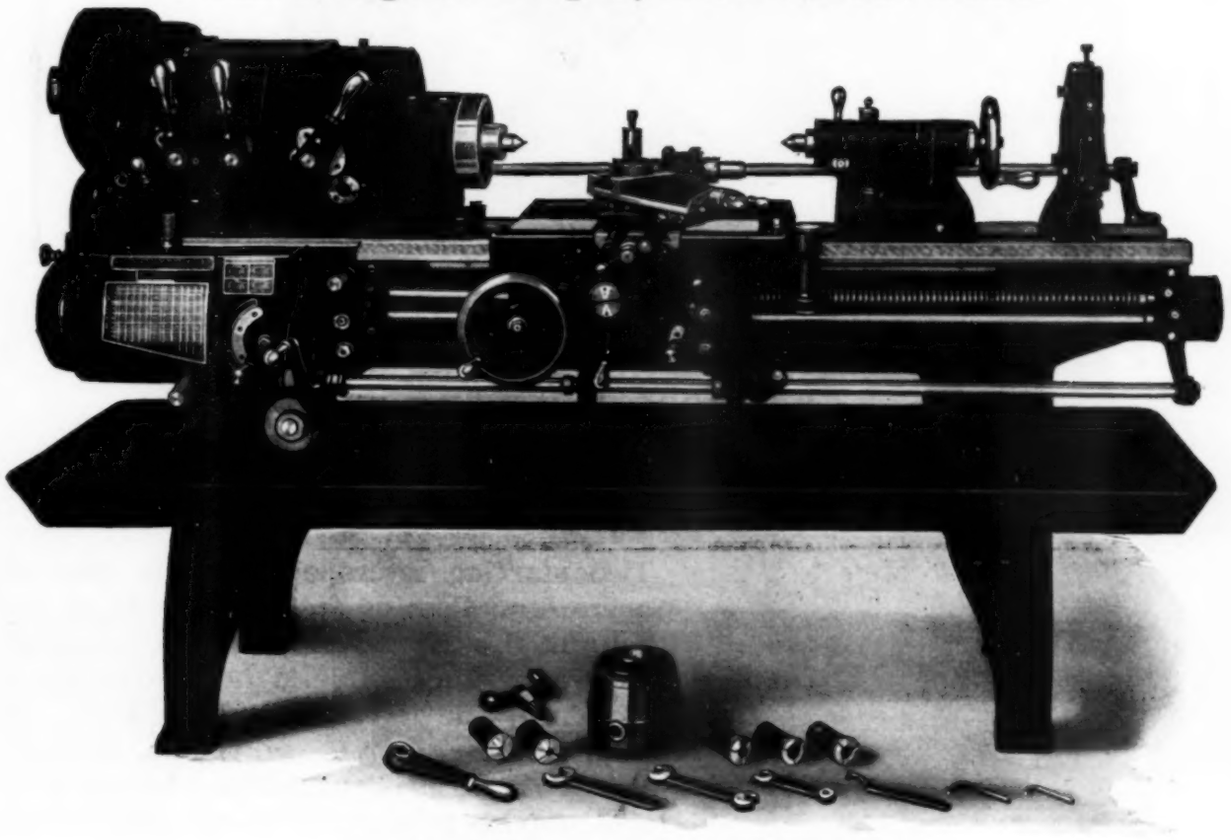
In buying a lathe, the investment standpoint should not be overlooked. Whether you are in the market for machinery or a screw driver you always have a range of prices from which to select. It is quite a temptation to save money on the initial purchase, but the man who knows, the man who really wants to save money, will not purchase the low priced article but the one from which he will get the greatest returns. Such an article will eventually cost him less and is selected purely from a quality standpoint.

Lodge & Shipley Lathes sell for more than some lathes but they cost less. That, after all, is the main consideration. It is not what you spend for a lathe that counts as much as what you get from it.

The design, the materials and the high grade workmanship are the reasons why you can ***do it better*** on a Lodge & Shipley.

Send for booklet on

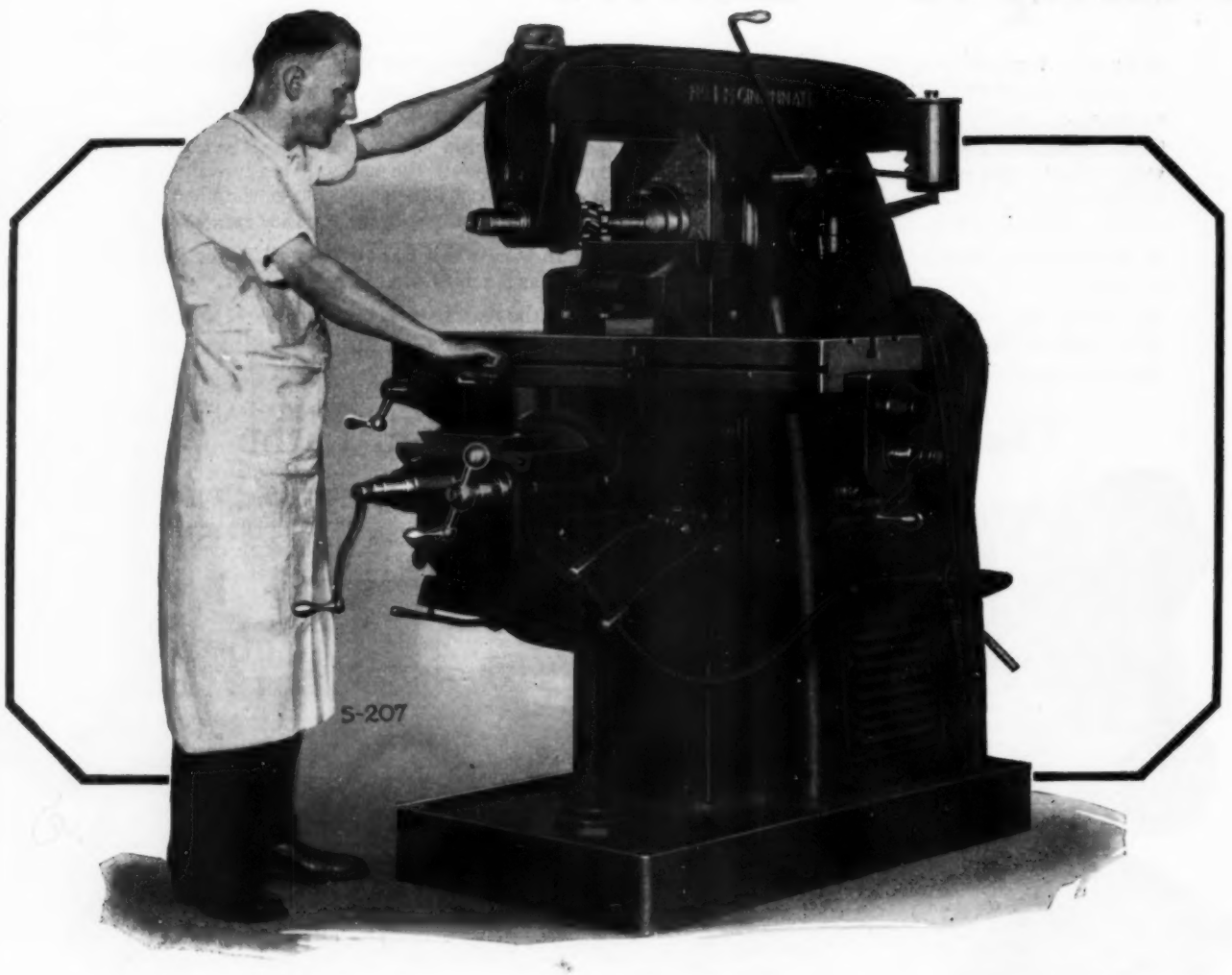
The Lodge & Shipley Tool Room Lathe



12 in. Selective Head Lodge & Shipley Tool Room Lathe
Tool Room Lathes also made in 14 in., 16 in., 18 in., 20 in. sizes

Machine Tool Co.
Ohio

Starts and Stops

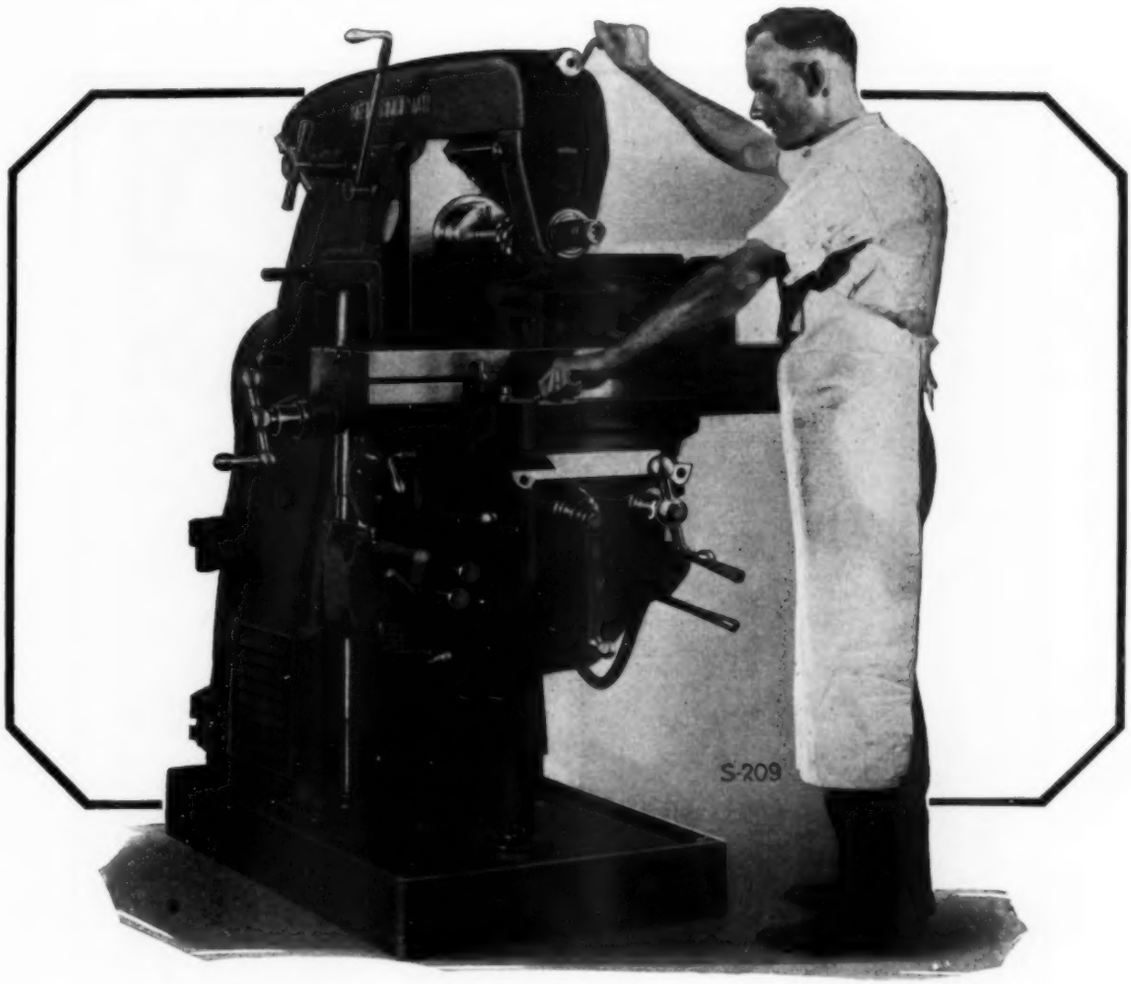


Two starting levers add to the ease of operation. Coming from the front of the column they are within easy reach, out of the way, yet accessible. When the operator stands at the left—the lever is there. A duplicate lever is on the other side. Regardless of where the job places him, he can start and stop his machine with ease and safety.

The Cincinnati Milling Machine Co.

CINCINNATI MILLERS

from either side!



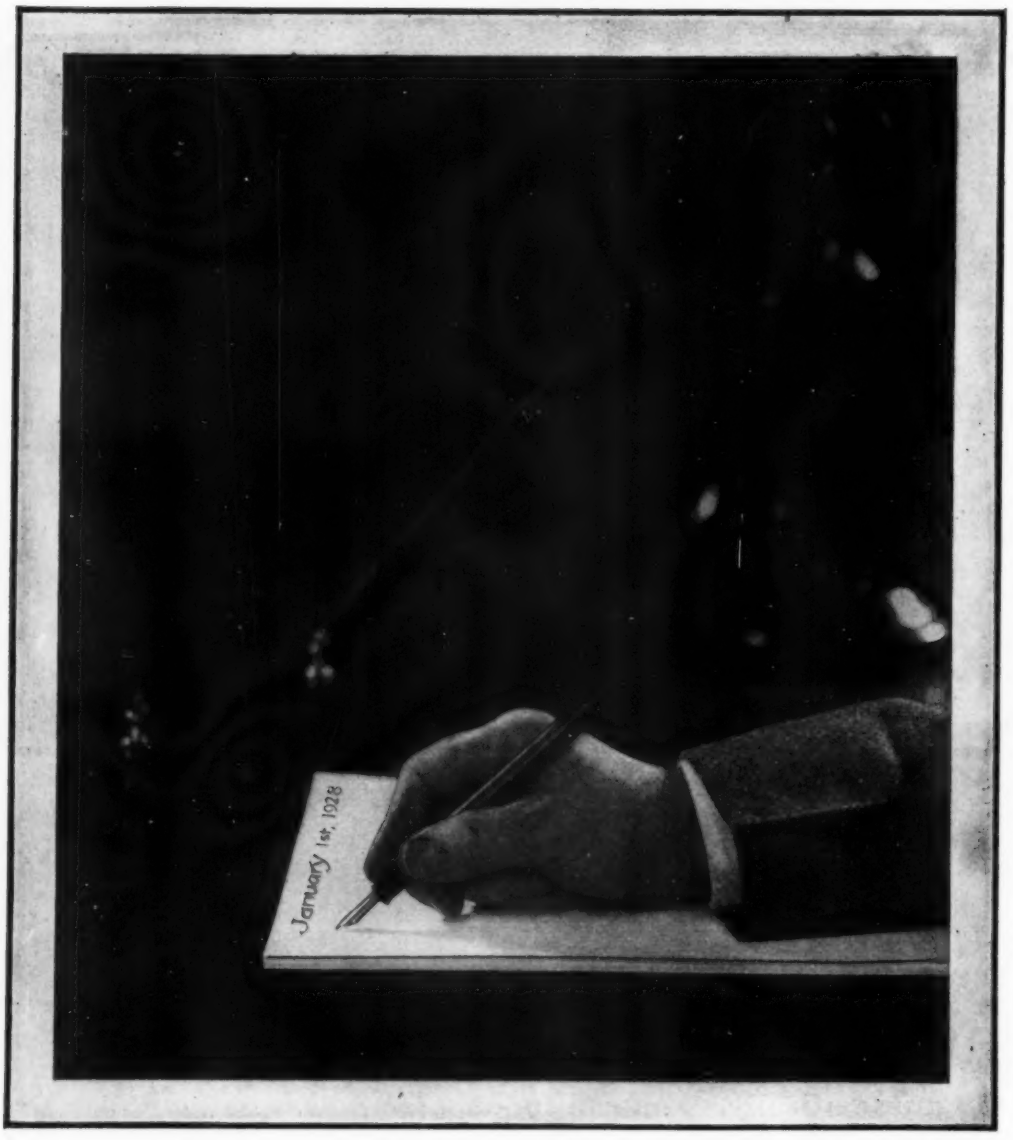
These levers control a multiple disc clutch of the latest type, running in oil, which adjusts itself automatically. You can forget adjustments on this clutch.

The double control is another time saver —profit maker.

Cincinnati, Ohio

CINCINNATI MILLERS

. . . . AMONG YOUR



THE CINCINNATI BICKFORD TOOL

R NEW YEAR RESOLUTIONS,

We suggest this one:

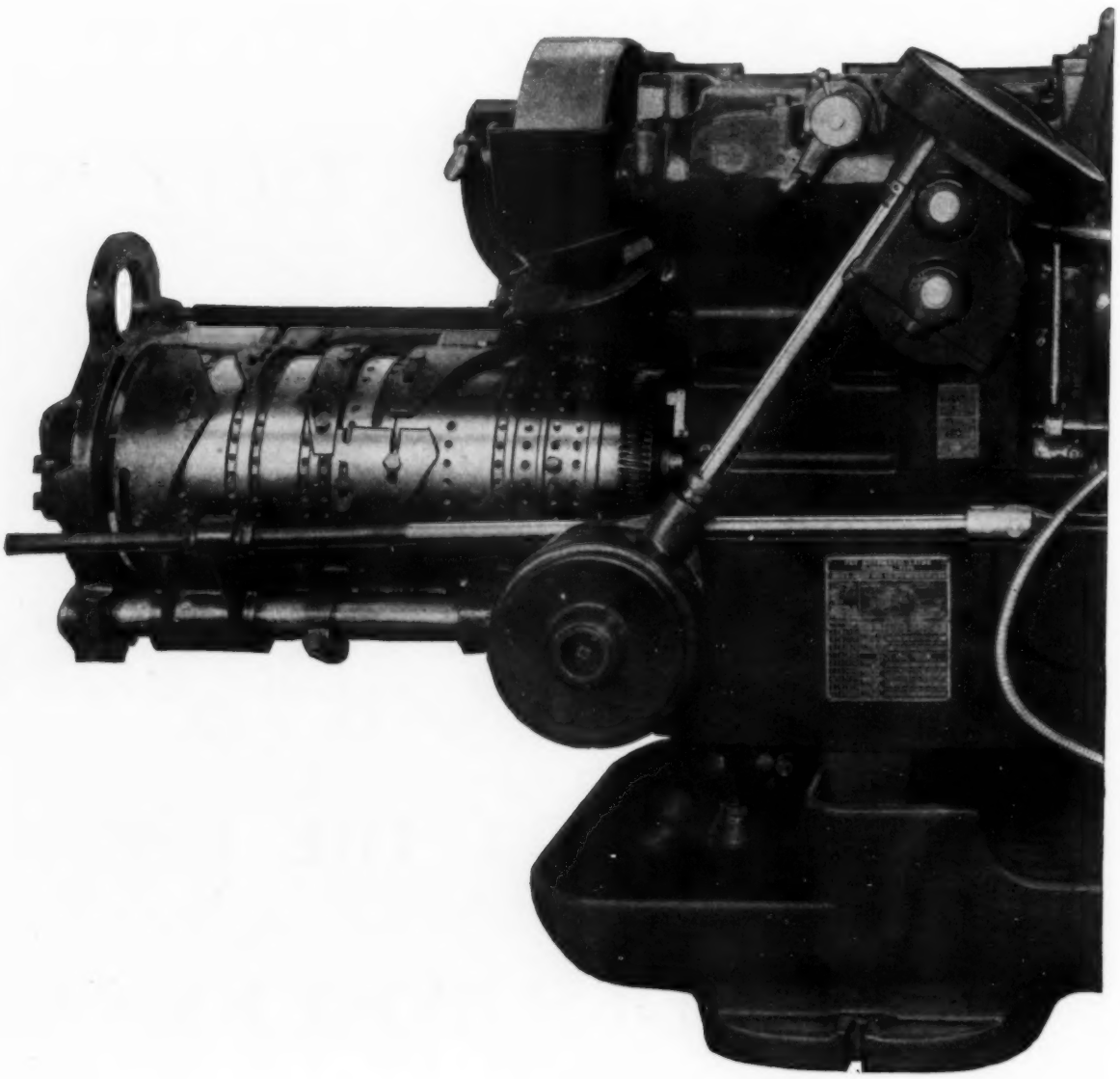
Resolved—THAT WE WILL INVESTIGATE THE SAVINGS THAT CAN BE MADE ON OUR WORK THROUGH THE USE OF SUPER-SERVICE RADIALS

COMPANY, OAKLEY, CINCINNATI, OHIO.

J&L
JONES & LAMSON

THE FAY AUTO

Three Fay Automatic Lathes, tooled on successive operations on cam shafts, were sold two years ago on a guarantee to produce 30 pieces per hour.



J&L
JONES & LAMSON

Hartness Flat Turret Lathe
Fay Automatic Lathe
Hartness Double Spindle Flat Turret Lathe

JONES & LAMSON

Springfield,

LOS ANGELES, CALIF.—Reeves & MacBride, 443 East Third Street

SAN FRANCISCO, CALIF.—C. F. Bulotti Machinery Company, 829-831 Folsom St.

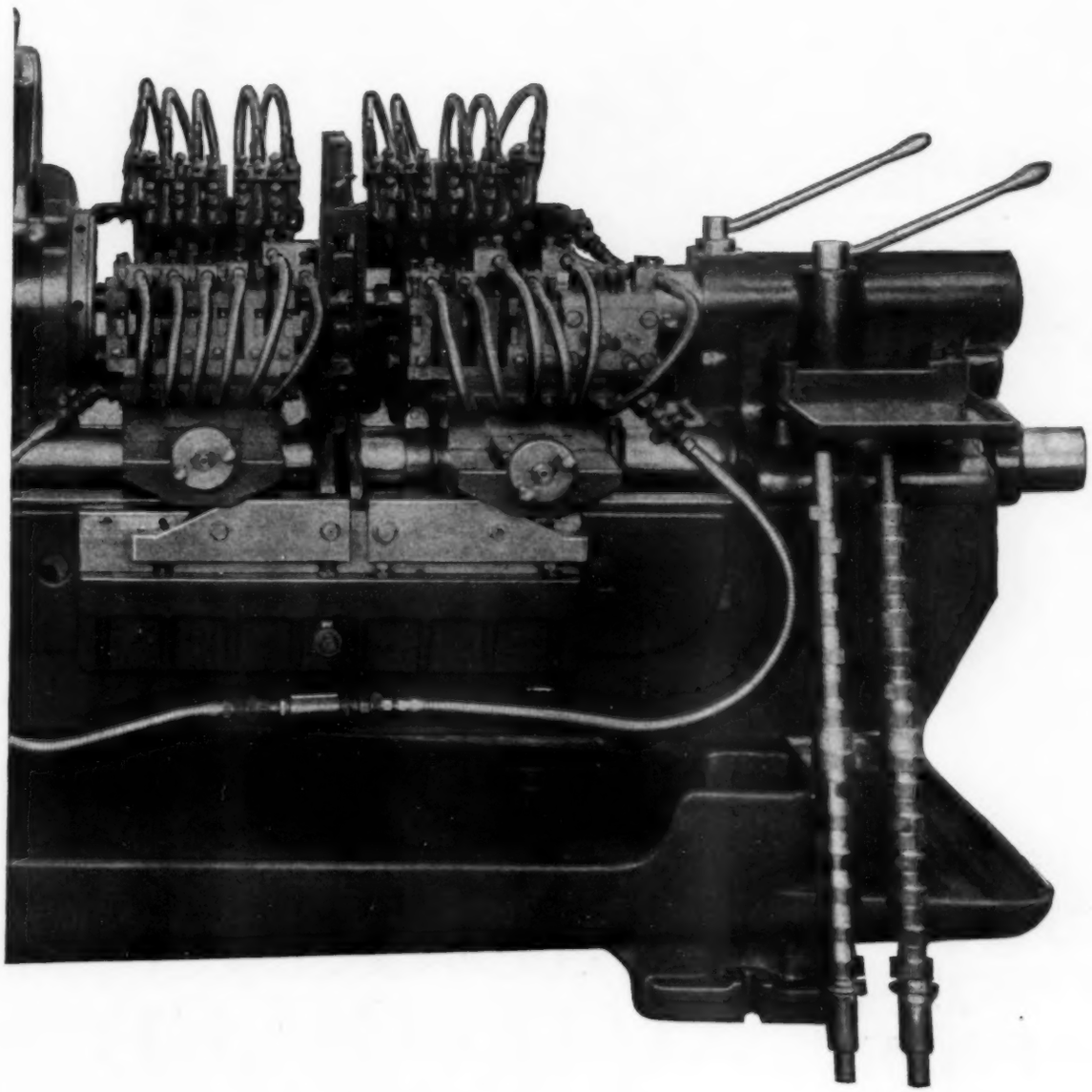
Pacific

Canadian
DUNDAS, ONTARIO—John

MATIC LATHE

J&L
JONES & LAMSON

Today the output averages 60 per hour. One operator, three machines, one finished cam shaft per minute.



MACHINE COMPANY

Vermont, U. S. A.

Hartness Automatic Die
Flanders Ground Tap
Hartness Screw Thread Comparator

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SEATTLE, WASHINGTON—Perine Machine Company, 209 First Avenue, South
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Betram & Sons Company, Ltd.

The
AMERICAN
TOOL WORKS
COMPANY
·CINCINNATI · U·S·A·

The New AMERICAN AUTO-OILED SHAPER

Lathes—Radials—Shapers

SATISFACTORY . . . in Every Respect!

That's the verdict passed on to us by the American Can Company, who have tested out the New American Auto-Oiled Shaper.

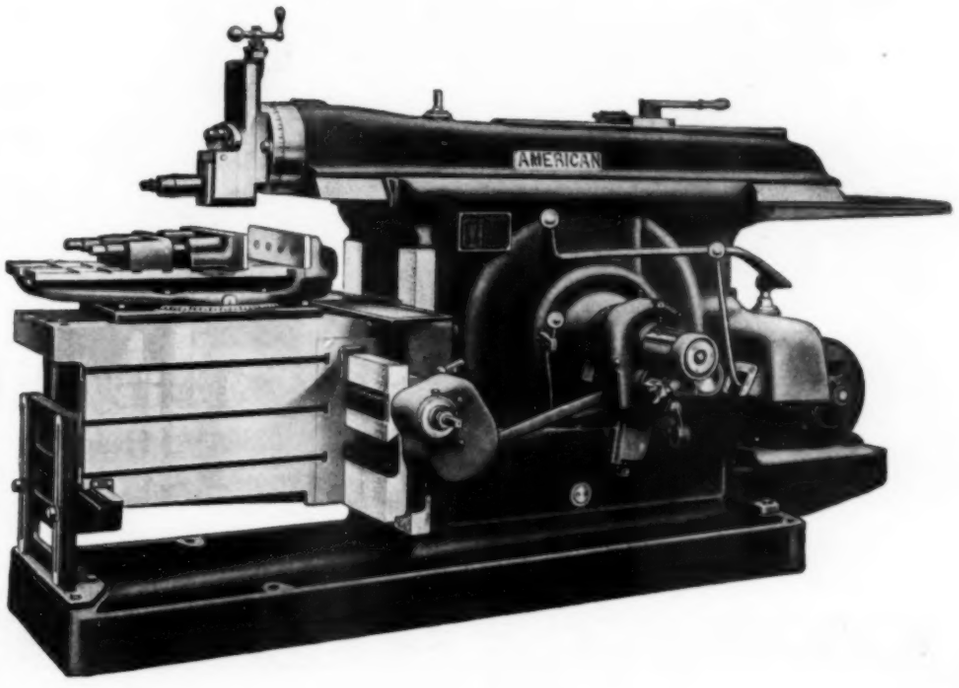
For the past year, this 20-in. model has been put through its paces on all manners of complicated Die and Toolroom work. Their requirements are most severe, yet this machine has met every one with utmost ease.

Progressive manufacturers the country over have purchased this new unit and found that it has lived up to every claim.

The New "American" Auto-Oiled is the embodiment of all that is modern and best in shaper design. Incorporating all of the latest thoroughly proven features, it definitely advanced all current conceptions of Shaper practice.

In keeping with the trend of the times, Timken Roller Bearings provide smooth rolling action that gets full power through to the tool. With automatic lubrication to every wear point, the useful, accurate life of the whole machine is considerably lengthened.

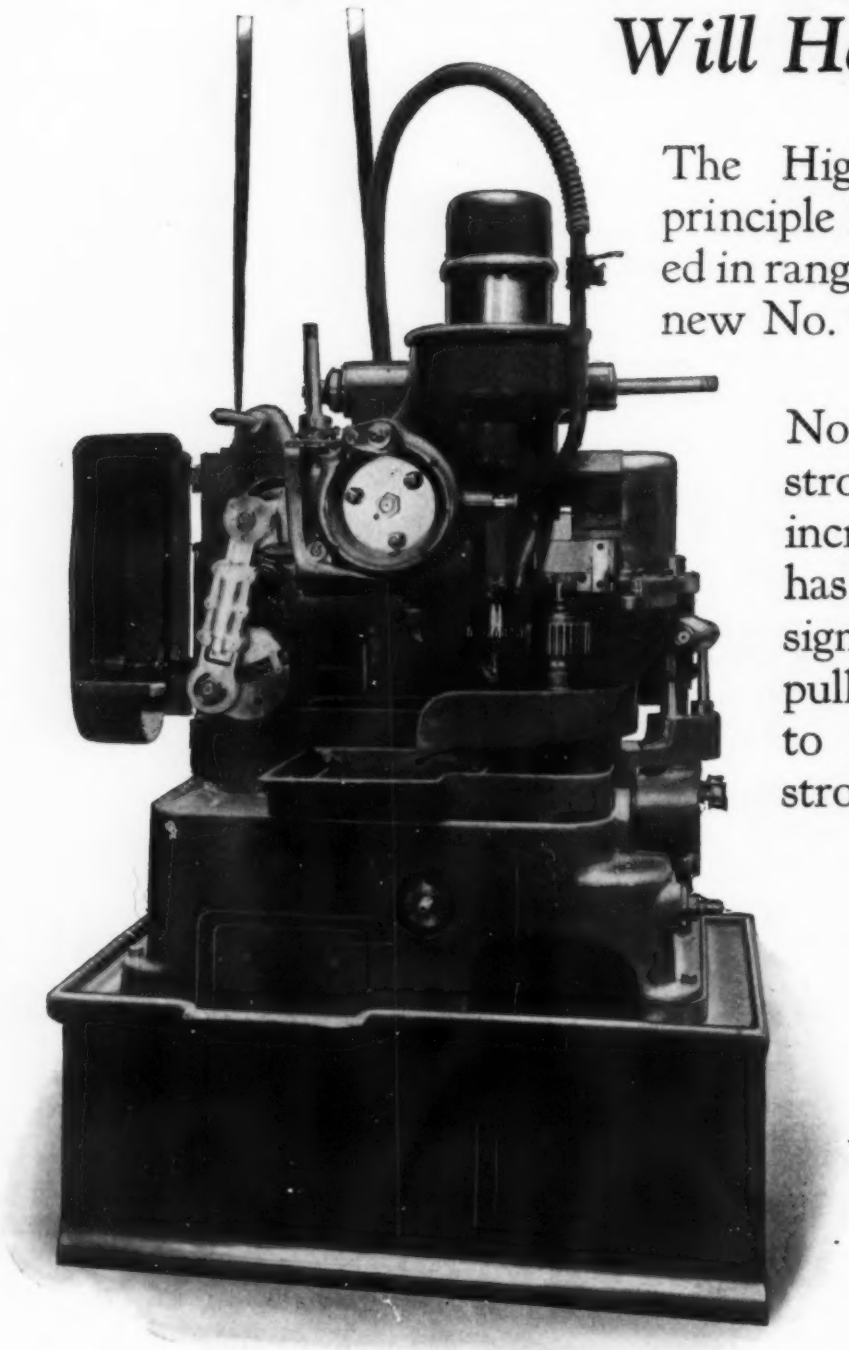
There are many other features such as the easy setting for stroke, the direct reading cross-feed, the multiple-splined roller bearing mounted gear shafts, carrying the alloy steel gears, the multiple disc clutch which guarantees an unusual sensitive control, the oversize sliding block; deep, well reinforced "v" slides, etc.



We invite your inspections of its many features through the medium of a 20-page bulletin, just off the press.

THE NEW No. 7A HIGH-

Will Help You Increase



The High-speed Gear Shaper principle has been greatly increased in range and possibilities in this new No. 7A-type machine.

Not only has the cutting stroke of the machine been increased, but the machine has been proportionally designed from the driving pulleys to the cutter spindle to handle this increased stroke.

Front View of No. 7A High-speed Gear Shaper. Operating-Arm Guard opened to show how driving members have been strengthened to take care of the increased stroke.

THE FELLOWS GEAR

Head Office and Works: 78 River Street,
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FOREIGN AGENTS: Alfred Herbert, Ltd., Coventry England—Great Britain; Alfred Herbert (India) Ltd., Calcutta and Bombay—India; Alfred Herbert, Ltd., Osaka and Tokio—Japan and China; Alfred Herbert (Australasia), Ltd., Sydney—Australia; Societe Anonyme Alfred Herbert, Paris—France and Spain; Societa Anonima Italiana Alfred Herbert, Milan—Italy; Societe Anonyme Belge Alfred Herbert, Brussels—Belgium and Holland; Bohm & Bormann, Berlin—

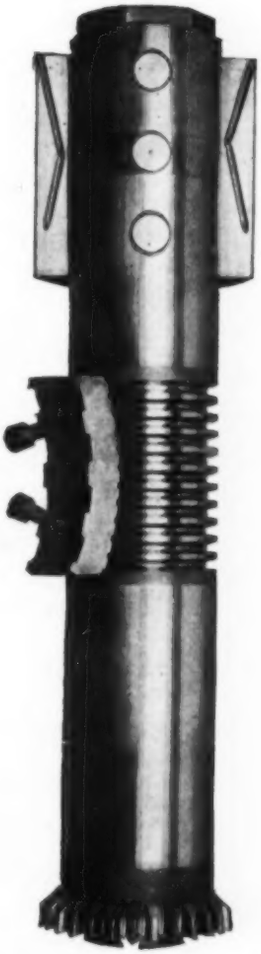
SPEED GEAR SHAPER

Your Profits in 1928

The cutter-spindle on the 7A-type High-speed Gear Shaper, as the illustration shows, is made in one piece, and is 3⅜ inches diameter. The guide is held direct to the spindle, and operates against a shoe in the upper index-wheel housing. The cutter-spindle is made hollow, reducing the weight, and permitting high-reciprocating speeds to be employed.

Speed, accuracy, and endurance are the cardinal features of this new High-speed Gear Shaper. It will unquestionably help you increase your profits in 1928.

Our booklet No. 7 tells you more about it—a copy is waiting your request.



The one-piece cutter-spindle used on the 7 A High-speed Gear Shaper. Cutters 4-in. PD with 1¾-in. hole are used on this spindle.

SHAPER COMPANY

Springfield, Vermont, U. S. A.
Detroit, Mich.

Germany, Czecho-Slovakia and Austria; Aktiebolaget A. Bonthrom, Stockholm—Sweden, Finland and Norway; Mathy-Doret & Ferrer, Zurich—Switzerland.

PACIFIC COAST REPRESENTATIVE

Louis G. Henes, 75 Fremont St., San Francisco, 218 E. Third St., Los Angeles—California, Arizona and Nevada.

Does it pay to repl

ON MOTOR shields one Bullard Mult-Au-Matic replaced five semi-automatic lathes and equalled their output at lower cost. The floor space reclaimed was 80% and handling costs were reduced to a low figure.

Did it pay to replace?

You answer.

On timing gear blanks one Bullard Mult-Au-Matic does the work formerly produced on 10 semi-automatic lathes and saves $19,653.40 a year.

Did it pay this manufacturer to replace?

You answer.

Sixteen Bullard Mult-Au-Matics replaced 85 turret lathes in machining automobile parts. Two Mult-Au-Matics produce 40 hubs per hour. Four turret lathes produced 15.

Daily savings on this job alone, $15.12.

Did it pay to replace?

You answer.

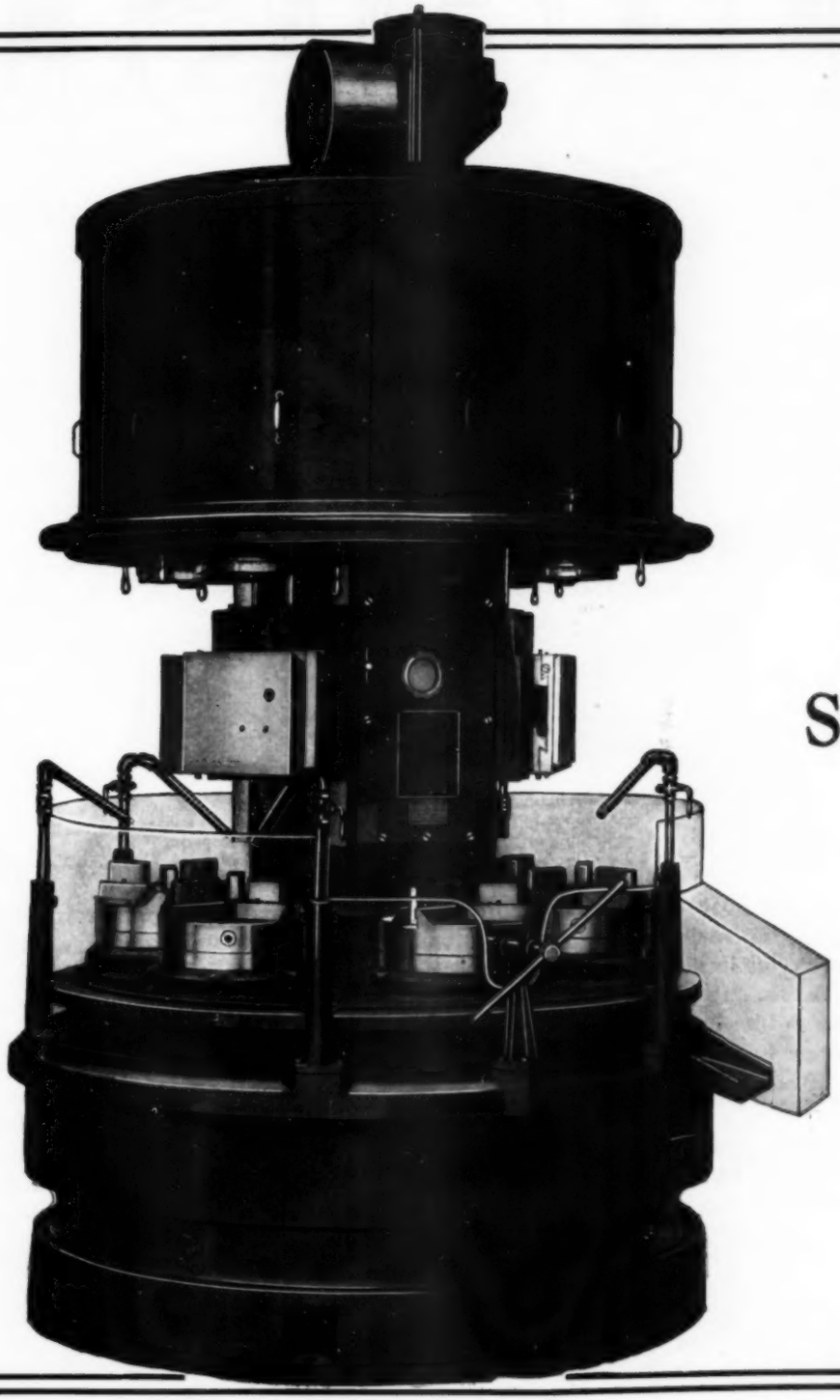
Now we'll answer—any questions as to time and cost of machining your parts by the Mult-Au-Matic Method and show you that you are overlooking good profits.

Ask us.

MULT-AU-MATIC

1 minute
42 seconds

ace? You answer

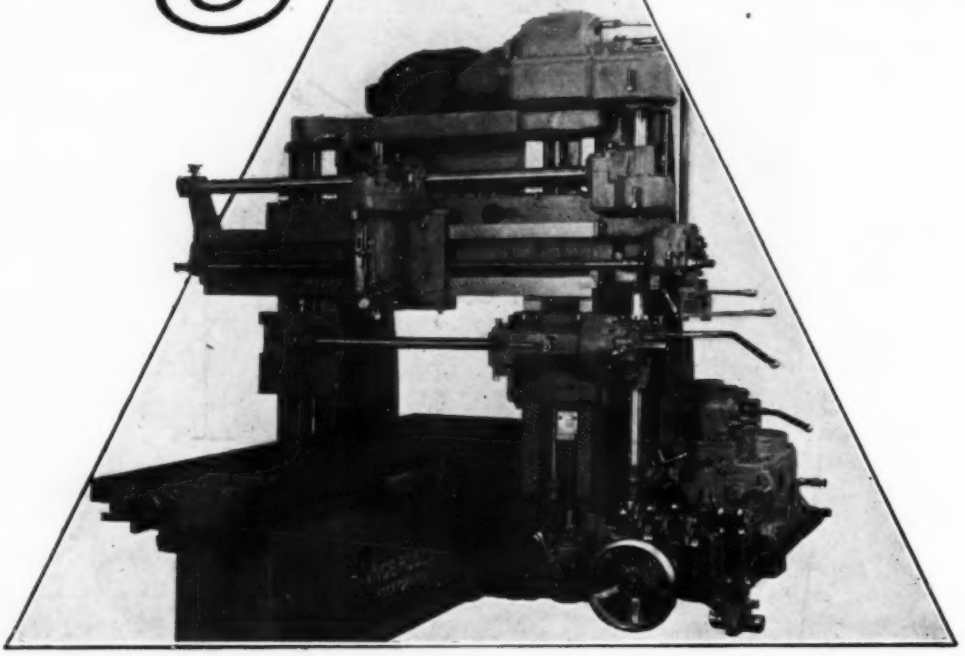


6"
8"
12"
16"
20"
Sizes

BULLARD

Bridgeport, Connecticut

Ingersoll



STANDARD PATTERN ADJUSTABLE RAIL

The Ingersoll adjustable rail is a multiple spindle milling machine for general work in shops having large or medium sized castings to finish. It is convenient and very accurate, and its flexibility and ease of control permit the rapid finishing of a wide variety of castings.

This machine is built in two patterns and practically any size. The standard pattern is for shops doing average work and the heavy pattern for shops milling large, heavy iron and steel castings, die blocks and similar work. The 24-in. x 6-ft. standard pattern machine above is as small as these are usually built, and they range from this to machines with tables 12 feet wide and 36 feet long. Each machine is built as a special job as to size and saddle equipment, but the general design has been standardized so that no one machine bears the engineering cost of a new design.

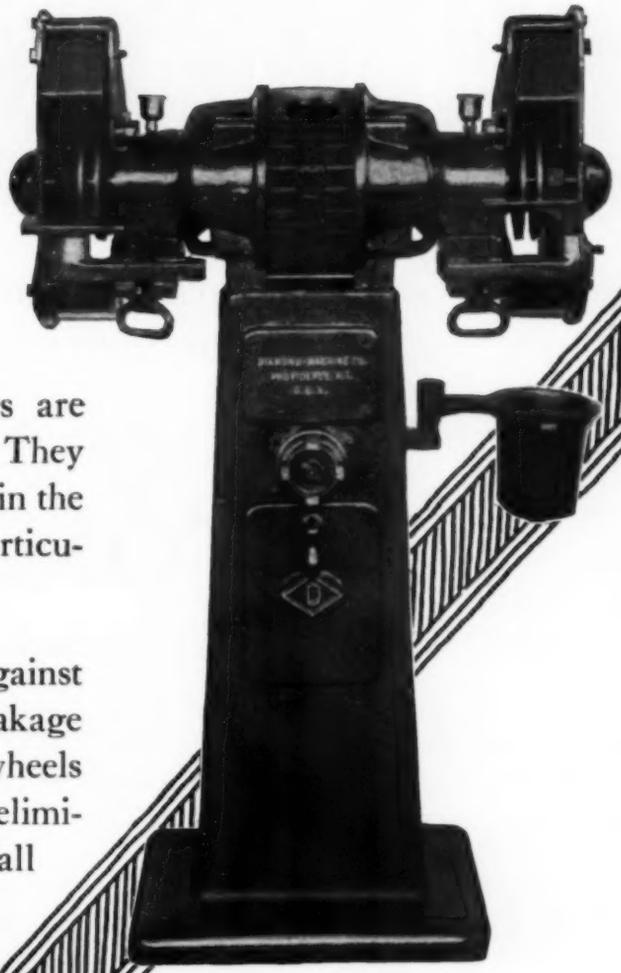
Write for Descriptive Bulletins:

No. 44—"Ingersoll Milling Cutters."
No. 45—"Ingersoll Face Milling Cutter Grinder."
No. 46—"Ingersoll Equipment for Railroad Shops."
No. 47—"Ingersoll Milling Machines."

The Ingersoll Milling Machine Co.

Milling Machines and Their Equipment
Rockford, Illinois

Gets Plenty of Hard Work and But Little Attention



General utility floor grinders are subjected to continuous abuse. They are used by any and every one in the shop which means no one in particular gives them much care.

Ball bearings can be sealed against grinding dust and lubricant leakage —loose spindles, out of true wheels and shorted armatures are eliminated when New Departure Ball Bearings are used. Maintenance is thereby reduced to practically nothing.

Let New Departure engineers help to solve your bearing problems without obligation. Write for data service bulletins giving detailed information on ball bearing application. Sent on request.

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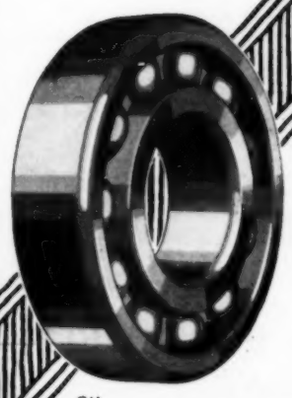
Chicago Detroit
San Francisco



811

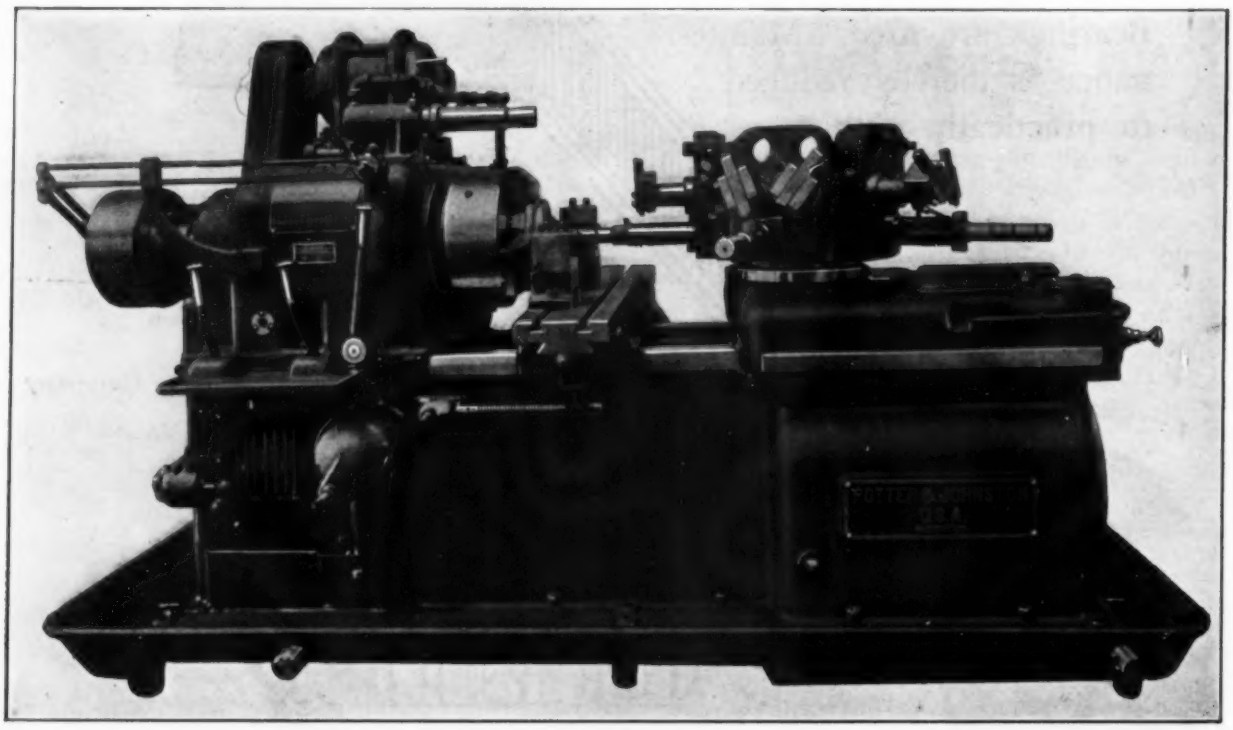
New Departure Quality Ball Bearings

Reduce overhead and increase profits
with modern machine tools

POTTER & JOHNSTON AUTOMATICS

What return will I get for each dollar spent is the vital question involved in the purchase of new machine tools.

A careful study of the construction features of the P. & J. line of automatics will convince you that their installation in your production line will mean reduced overhead and increased profits.

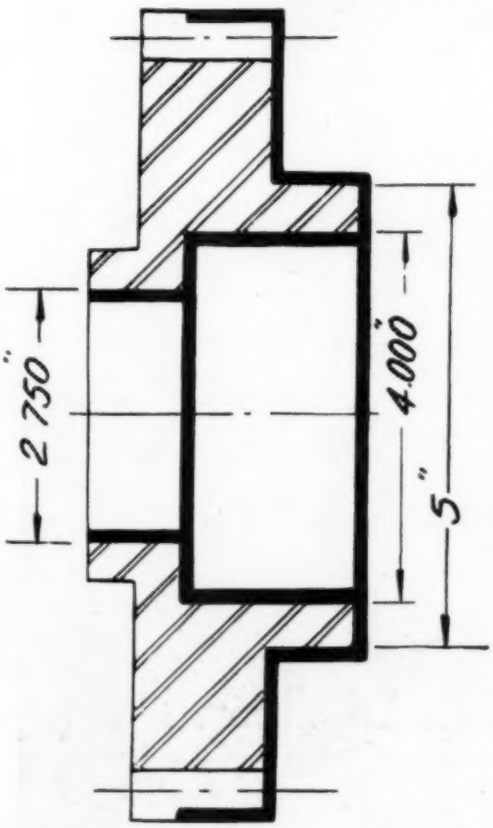


The photograph above shows our latest development, the **POWER-FLEX AUTOMATIC** set up for handling forged steel gear blanks.

S TON AUTOMATICS

Your gear blanks can be produced economically and at a high rate of production on the latest type

Potter & Johnston Automatics



The first operation on this 31-40 forged steel gear blank can be handled in 9 minutes.

The former method required 18 minutes. The result is a direct saving of 50% in production costs.

One machine is now doing the work which formerly required two.

On this class of work one operator can handle four machines resulting in a substantial saving in labor costs.

These facts are worthy of your consideration.

POTTER & JOHNSTON MACHINE COMPANY
PAWTUCKET, RHODE ISLAND, U. S. A.
Representatives in the principal cities of the world

THOSE who attended the Machine Tool Exposition at Cleveland were amazed at the performance of the new MIL-WAUKEE-MIL. The cuts were in tough carbon steel—feeding down with the cut—the worst possible abuse to which a milling machine can be subjected. And yet the feed was so velvety smooth that you scarcely knew the machine was running.

KEARNEY & TRECKER CORPORATION

The COLBURN HEAVY DUTY BORING MILL

Here's the Newest Model!

EASE of control and simplicity of operation are outstanding Colburn features. But equally important in keeping production "in high" is the smooth, powerful action obtained by the spiral bevel table gear and the driving gears of chrome nickel steel. Ball bearings throughout the drive also do their share in making this a more than usually powerful machine; they conserve more than 30% of the power absorbed by ordinary bronze bearings and deliver it to drive the table.

Here is a truly modern mill—easy to handle and with the weight and power to test your finest high speed tools to their limit.

Built in 7 sizes—from 36 in. to 84 in. swing.

A *Few* COLBURN *features that boost* PRODUCTION

Single Lever Control

For engaging feed and rapid traverse of heads in all directions.

Front Control

All operating levers are located at front of machine within convenient reach of operator.

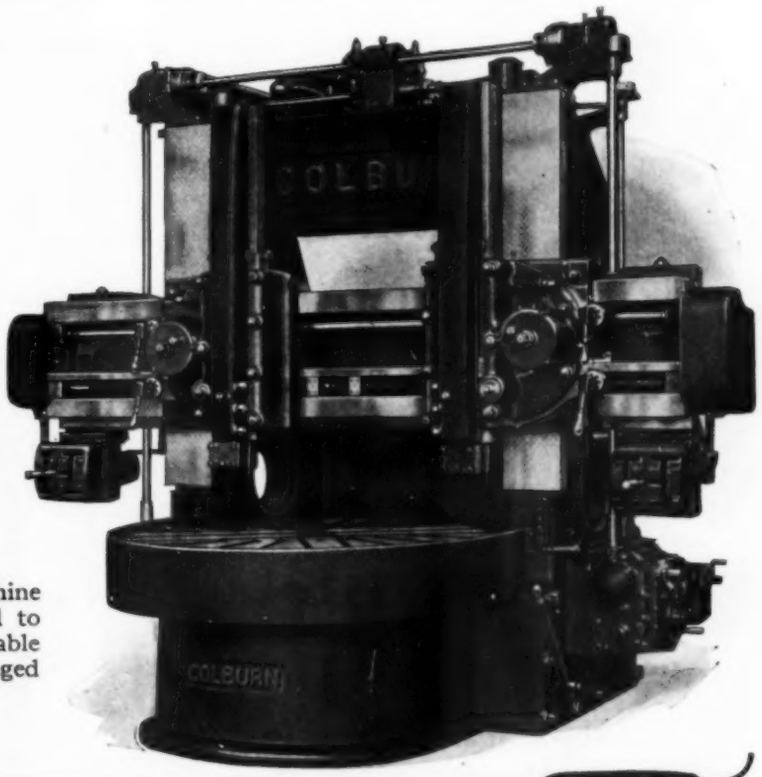
Exceptional Range of Speeds and Feeds

Sixteen feed changes are available in geometrical progression from .006 to 1 in. per revolution of table. Three mechanical speed changes combined with the number of points on the controller give an unusual range of speeds.

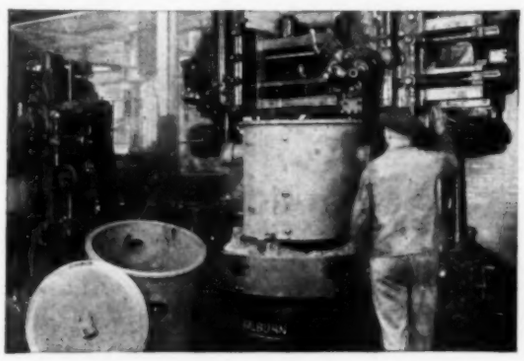
Accuracy

Close adjustment ratchets, carrying micrometer dials mounted on heads, and scale and pointer on rams or turret slide permit rapid and accurate tool setting.

Interlocking device that prevents starting machine before gears are fully in mesh, table guarded to protect operator and a brake that stops table automatically when driving clutch is disengaged are features that make fast operation *safe*.



Have you a recent catalog?



Single Lever Control for Feed and Traverse

CONVENIENT—FAST—SAFE

A single lever at front of machine controls both Feed and Rapid Traverse of head and ram—in, out, up, or down—and this may be done with table at rest or in motion.

It is impossible to engage both feed and rapid traverse at the same time—no chance to make a mistake. As easy to operate as the gear shift on your car.

BETTS..NEWTON..COLBURN..HILLES & JONES..MODERN..HARRINGTON

CONSOLIDATED

CONSOLIDATED MACHINE TOOL CORPORATION *of* AMERICA, Rochester, N. Y.

No. 1

Design that makes a saving before the wheels commence to turn

a feature of the
New 20" Hendey Lathe

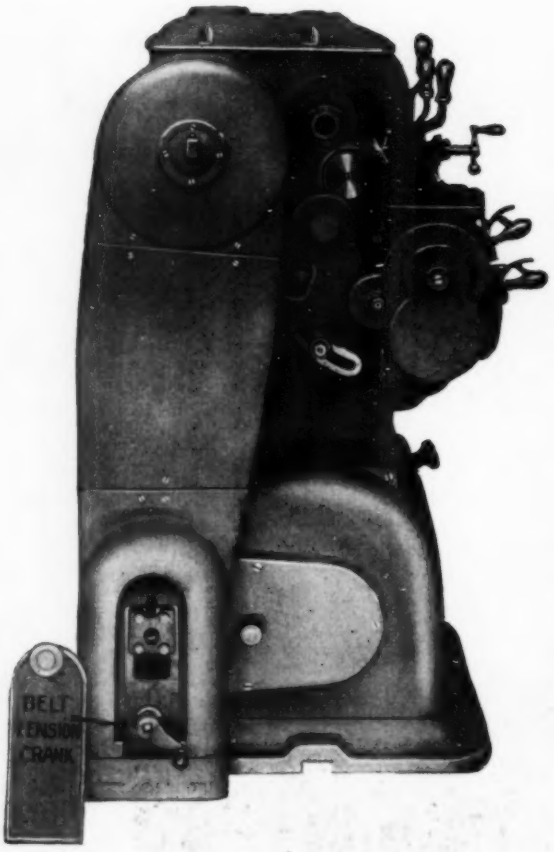
There are advantages in individual motor drive.

Mounting the motor in the base makes for clean headroom. There is little overhang, hence economical placement is easy. Again, the motor being placed on the floor, there is virtually no chance of vibration reaching the work.

Note the vented doors—plenty of air circulation provided. Easy to get at the motor for oiling, too.

The drive is by silent chain to jackshaft, and thence by a wide double belt to headstock pulley. Belt tension is easily adjusted by a crank—a matter of 20 seconds time.

The above features are found in the new Hendey 20-in., 12-speed Geared Head Lathe. Illustrated bulletin outlines other improvements of this advanced design.



LATHES
SHAPERS

HENDEY
MACHINE CO., TORRINGTON, CONN.

MILLING
MACHINES

For your most exacting drilling requirements

the Union Ground Drill

THESE tools are designed to stand the strain of extensive production schedules. No matter what test you put them to, Union Ground Twist Drills always prove "capable tools that lower costs."

On multiple drilling operations for example, you cannot afford to experiment. Your drills must be absolutely uniform in size, in quality and in material.

Union Ground Twist Drills are considered superior on all counts. They are dependable tools which insure duplication of interchangeable parts.

Ground after hardening in all sizes from No. 60 up. Carbon or High Speed Steel.

UNION TWIST DRILL CO., Athol, Mass.

New York Store: 52 Reade St. Chicago Store: 11 So. Clinton St.

Makers of All Kinds of Cutters, Twist Drills, Reamers, Taps, Dies, etc.

Tools you buy again

Taps and Dies
S. W. Card Mfg. Co.
Division Union Twist Drill Co.
Mansfield, Mass.

Taps, Dies and Screw Plates
Butterfield & Co. Division
Union Twist Drill Co.
Derby Line, Vt. Rock Island, Quebec

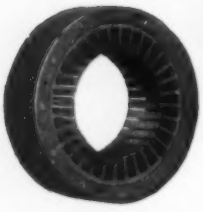
AGENTS THROUGHOUT THE WORLD

Heald

Jobs:

Flanges
Housings
Triple Valves
Motorcycle Cylinders
Reamers

Cluster Gears
Sprockets
Connecting Rods
Yokes
Cams



Motor Stators
Bushings
Refrigerator parts
Aeroplane cylinders
Valves

Look to HEALD for Ground Holes

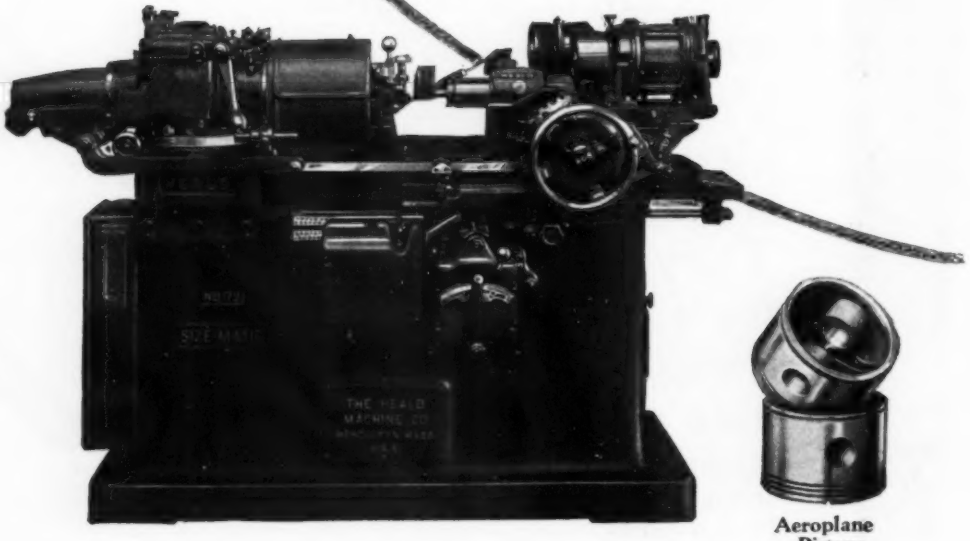
Pearing races, gears and cylinders were principally the work acknowledged as belonging to internal grinding only a few years back. Today, speed, change of design, harder materials, quietness, longer life and a score of other reasons have made grinding a necessity in practically every line of business.

Heald has met this demand by not only being able to finish any hole that it is possible to grind but in most cases doing it automatically.

Every day, new internal grinding jobs are presented to our Sales Service Engineering Department for solution and almost invariably the data supplied the customer invites the sale of a Heald. Why—

BECAUSE HE CANNOT AFFORD NOT TO BUY IT.

Read that again—then start some of your internal jobs towards Worcester today.

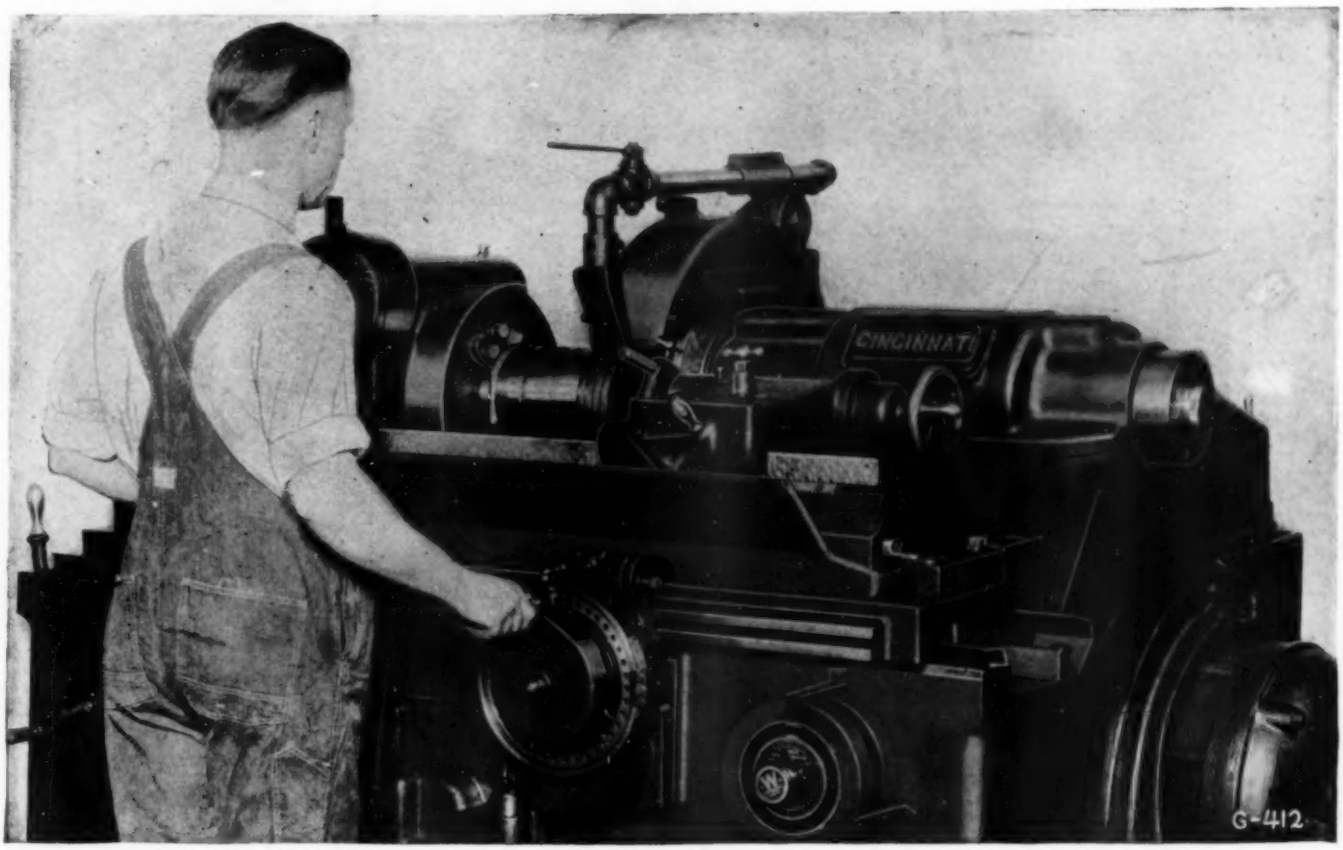


Heald
Size-Matic
Internal
Grinders

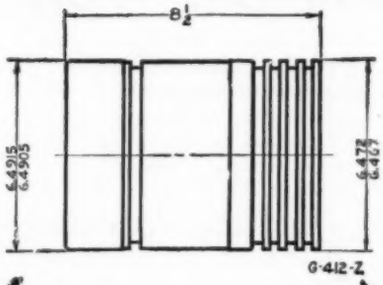
Aeroplane Pistons

THE HEALD MACHINE Co.

WORCESTER MASS., U. S. A.



(PATENTED)



Machine—Cincinnati 12″ x 18″ Plain Self-contained Grinder.
Equipment—Special live center Piston Grinding Adaptor.
Part Name—Piston No. D-44-R.
Material—Cast-iron.
Operations—Rough and finish grind two diameters all over.
Present Production — 25 per hour.
Old Production—10 per hour.
Stock Removed—.015″.
Limits—.001″.
Finish—Good.
Wheel Size—20″ x 3″ x 12″.

25 PER HOUR ON THESE BIG FELLOWS

—and what is more interesting, this more than doubles the previous production, which was ten per hour.

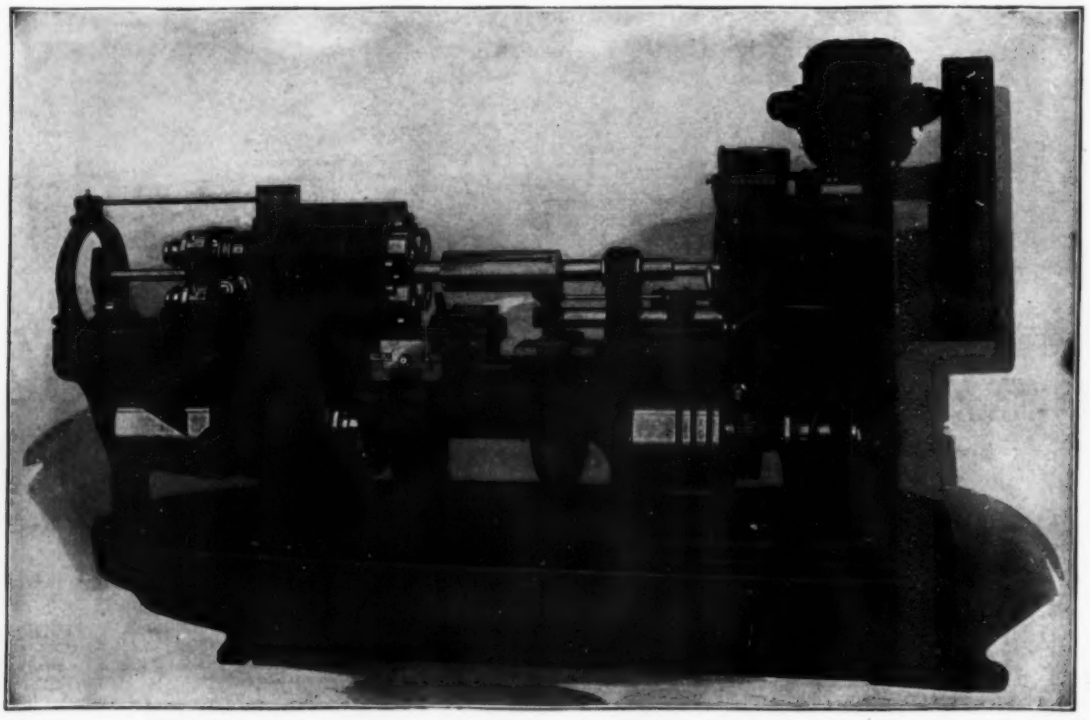
This is a job from a large tractor manufacturer in the Middle West who recently installed a 12″ x 18″ Self-contained Cincinnati machine.

It is only one of a great many jobs placed on this Grinder. With a wide range of work rotative speeds changed electrically and with a range of twelve rates of table traverse, this machine (self-contained motor drive) can handle a great variety of parts. Heavy roughing cuts can be taken with slow table traverse as readily as light finishing cuts with a more rapid rate of table traverse speed.

CINCINNATI GRINDERS INCORPORATED
CINCINNATI, OHIO

CINCINNATI GRINDERS

NEW 4-SPINDLE ACMES



For Lower Costs and Higher Accuracy On the Larger Sizes of Bar Work

The day of the slow, cumbersome and inaccurate large size Multiple Spindle Automatic has passed. Production men are now demanding the same accuracy and efficiency in the Multiples for heavy parts as they are getting in those which turn out the small, light work.

Model "B" 4-Spindle Acmes fully meet the demand for large Multiples which combine accuracy with snappy action. High speed in these new Acmes has not been attained however through the sacrifice of proper weight and rigidity in those parts which must absorb vibration and resist deflection.

Model "B" Acme speed and smoothness have been attained, and the rigidity of the machines increased, through careful attention to engineering details. Revolving parts are carefully balanced, uniformly accelerated and retarded motion is given to those parts which act intermittently, and such details as gears, bearings and lubrication have not been left to chance.

Nothing interferes with the remarkable tooling possibilities of Model "B" Acmes. The stock stop snaps out of the way the instant its function has been performed. The cross slides are rugged and powerful and of unusual area. They enable the largest forming tools to operate at any or all positions. The unique Acme Telescoping Turret is permanently aligned with the spindles and will carry not one, but *several* sets of "close held" tools at each and all of the four positions.

Model "B" 4-Spindle Acmes are built in two bar capacities—2¼ in. and 3-5/16 in.—Belt driven or motorized.

The National Acme Company

Cleveland, Ohio — Windsor, Vt.

New York — Detroit — Chicago

Makers of Acme and Gridley Multiple Spindle Automatics, Gridley Single Spindle Automatics and Gridley Multiple Spindle Chucking Machines at Windsor, Vermont, and Namco Opening Dies, Collapsing Taps, Screw Machine Products and "Positive" Centrifugal Oil Separators and Clarifiers at Cleveland, Ohio

New—

A special tap for SAE or General Motors Class 2 limits:—

One, Two, Three

1. A tap has been developed by us for use on production jobs with limits similar to SAE Class 2 Specifications or General Motors Class 2 Specifications.

2. On several tests recently completed the cost per tapped hole has been reduced nearly 50%.

3. The new tap is being sold at *no advance in price.*

That is the story in three short sentences. Tap men with jobs whose limits are similar to the above are urged to try out some of these taps. The result will be surprising and pleasing.

Great Savings Possible

By replacing ground thread taps with this new GTD High Speed Tap, practically identical production can be obtained without the high cost of ground threads. This sounds too good to be true—but it is true, nevertheless. None of the production advantages inherent in ordinary ground thread taps are sacrificed. The new GTD tap will do just as good work provided the limits required are not finer than SAE Class 2 Specifications.

No Mystery

There is no particular "trick" about the new tap. We will gladly explain in detail the characteristics which cause its remarkable performance. They will be instantly appreciated by any mechanical man. But with the explanation we want a chance to show you what the new tap can do. So, when you send in the coupon, accompany it with an order for a few taps for test—and remember—Class 2 limits, or coarser.

Come to Headquarters!

GTD GREENFIELD TAP AND DIE CORPORATION

GREENFIELD, MASS., U.S.A.

New York—15 Warren St. Chicago—13 So. Clinton St.

Detroit—224-226 W. Congress St.

Canadian Plant: Greenfield Tap & Die Corporation of Canada, Ltd., Galt, Ontario

Greenfield Tap & Die Corp.
Greenfield, Mass.

Please tell me about your new production tap. I enclose a small order for Taps which we wish to try out.

Name .....

City .....

State .....

12-29-27

..for the Chief Executive..

More Money for Sales Effort

EVERY dollar saved on production cost means just that much more money and energy available for sales building. A set of Warner & Swasey Standard Bar or Chucking Tools illustrated here, will cut your turret lathe production costs 15% to 40%. This saving, which would otherwise be lost, can be put to work building up sales volume.

These Standard Tool Sets will handle all major bar or chucking operations, abolishing costly special tools and delays while they are being designed and made.

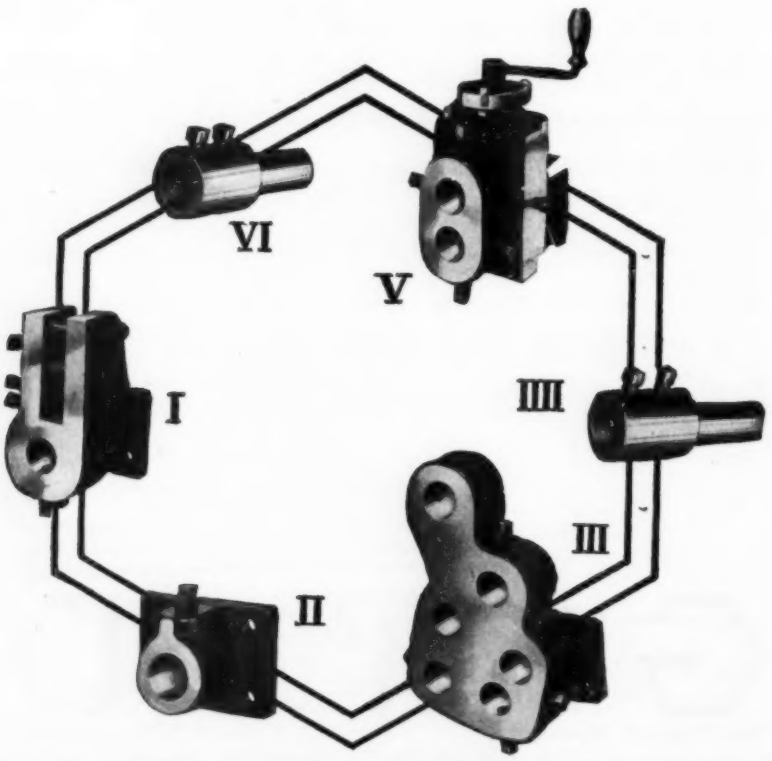
When a new job comes in, these standard tools are all set up and ready; shifting cutters and resetting stops is all that is necessary. If the design of a job is changed, these tools are not made obsolete like special tools. Subsequent tool cost is therefore restricted largely to forged cutters and chasers—keeping the tool cost low.

A Warner & Swasey engineer will gladly come and show you what definite savings W & S Standard Turret Lathe Tools can be expected to make in your plant.

While the matter is fresh in your mind, drop us a line on your letterhead, asking him to call and make a study of the possibilities in your plant.

Warner & Swasey Standard Chucking Equipment

Will handle a great variety and wide range of chucking work.



..for the Shop Foreman....

A Better Showing on Costs and Production

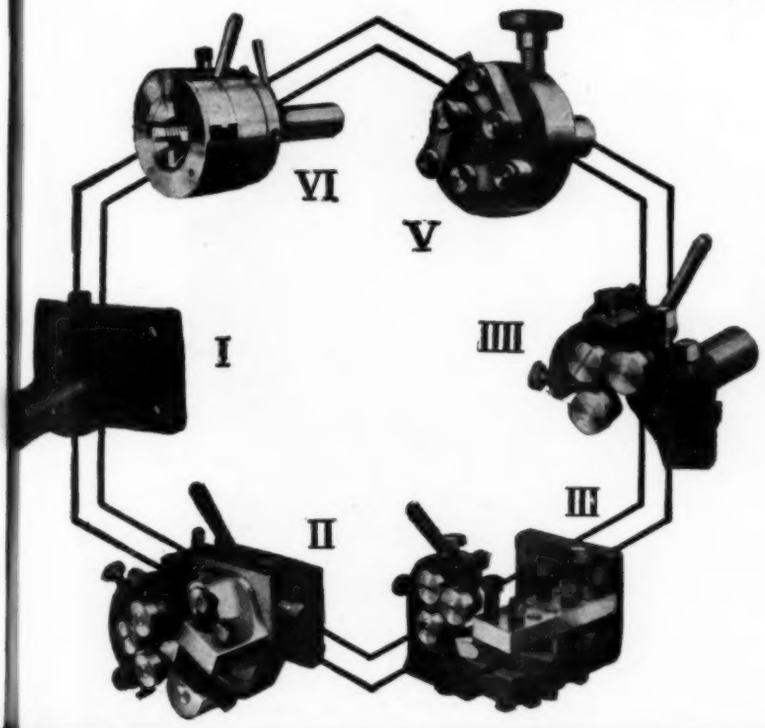
PRODUCTION and cost figures are the friend or foe of the shop foreman according as they speak favorably or not. A W & S Standard Bar or Chucking Set on your turret lathe will show a saving of 15% to 40% on your small lot production—the most difficult work on which to make a satisfactory showing.

The Standard Bar and Chucking Sets below provide tools for bar or chucking operations, and each tool can be adjusted to handle all the work within the range of the machine. Arranged in a permanent set-up on the hexagon turret, these W & S Standard Tools can be made to turn out a wide variety of work by merely shifting the cutter holders and cutters.

If you are interested in making a better showing on your cost and production figures, ask us to show you how W & S Standard Tools will help you. Also, mail the attached coupon for our new Tool-Data Book, showing the application of these and over 100 other W & S Standard Tools.

The Warner & Swasey Company

Cleveland, Ohio, U. S. A.



Warner & Swasey Standard Bar Equipment

A Permanent Tool Set-up for the majority of bar operations.

The Warner & Swasey Co., Dept. AM-215, Cleveland O.
Gentlemen: Please send me your Catalog Data Book showing 161 Standard Turret Lathe Tools for increasing production and cutting costs.

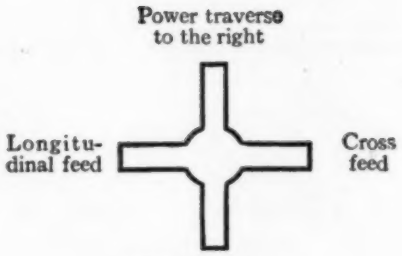
Name .....
(Please print your name plainly)

Care of .....
(Name of company where employed)

Street .....

City ..... State .....

Show this to your lathe operator



Rapid power traverse to the carriage is a regular feature on all Time Saver Lathes. It is operated by a 1 H. P. motor and is controlled by a convenient lever on the carriage in a natural working position. The same lever also engages longitudinal and cross feed. The above diagram shows the simplicity of this mechanism and what happens when the lever is thrown in its different positions.

FROM this diagram you can see the simple movements of the lever controlling the carriage of the Time Saver Lathe.

It is as easy to operate as the gearshaft of an automobile. The quick, simple control, combined with the speed and power, makes an operator like the lathe.

There is no greater factor for low-cost production than the keen admiration of the man for the machine.

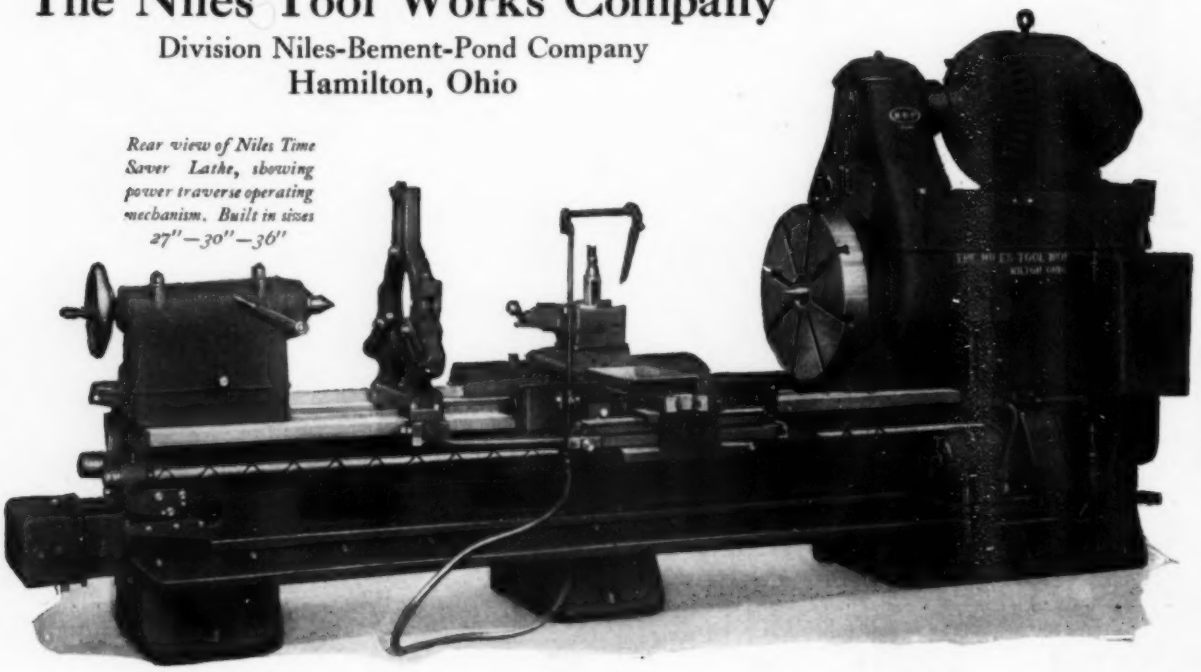
The lathe itself puts him on his mettle and impels him to work faster and better.

The inspirational value of a Time Saver Lathe is hard to figure exactly. But we *can* give you exact construction details, we *can* give you production estimates and records of performances, we *can* show you the value of investing your money in this machine. Write for the facts.

The Niles Tool Works Company

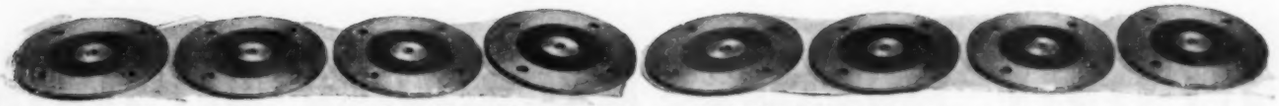
Division Niles-Bement-Pond Company
Hamilton, Ohio

Rear view of Niles Time Saver Lathe, showing power traverse operating mechanism. Built in sizes 27"—30"—36"



Sales Offices

BIRMINGHAM	PHILADELPHIA	LOS ANGELES	SAN FRANCISCO	PITTSBURGH
CLEVELAND	BOSTON	ROCHESTER	CHICAGO	DETROIT
	CINCINNATI	ST. LOUIS	NEW YORK	



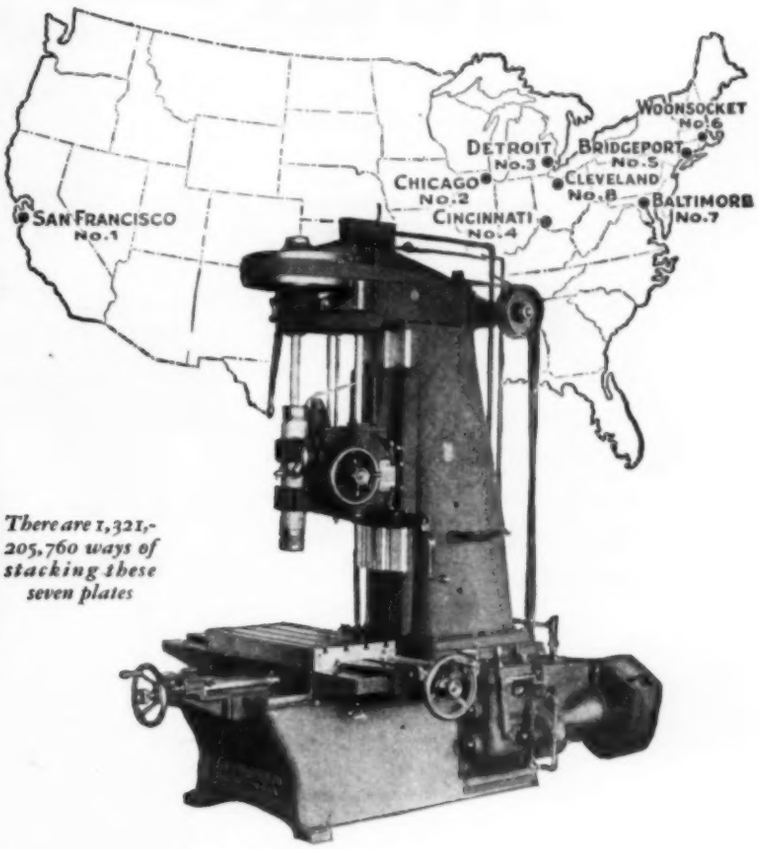
SAN FRANCISCO No. 1 | CHICAGO No. 2 | DETROIT No. 3 | CINCINNATI No. 4 | BRIDGEPORT No. 5 | WOONSOCKET No. 6 | BALTIMORE No. 7 | CLEVELAND No. 8

This almost incredible test!

Eight pieces of cast iron each accompanied by a blue-print were sent to eight concerns representing seven types of industry. All had P&W Jig Borers. They were asked to bore five holes, one in the center, four in circle 90 degrees apart. The purpose was kept secret. The jobs were done as part of the day's work by the regular operator.

There are 1,321,-205,760 ways of stacking these seven plates

8 PIECES OF IRON



Here is the astounding result

Seven of the plates were absolutely interchangeable and could be stacked in any desired combination with long plug gages .0002" under one inch passing through all seven plates. The eighth plate showed an error of +.0003". The fact that this small error prevented the stacking of the eighth plate proves the astonishing accuracy of the other seven.

THERE IS MORE TO THIS STORY

We have published a completely illustrated circular describing this wonderful but practical test.

Fill in the coupon below and get a copy

Send me a copy of "8 Pieces of Iron."

Name.....

Address.....

Company.....

Position.....

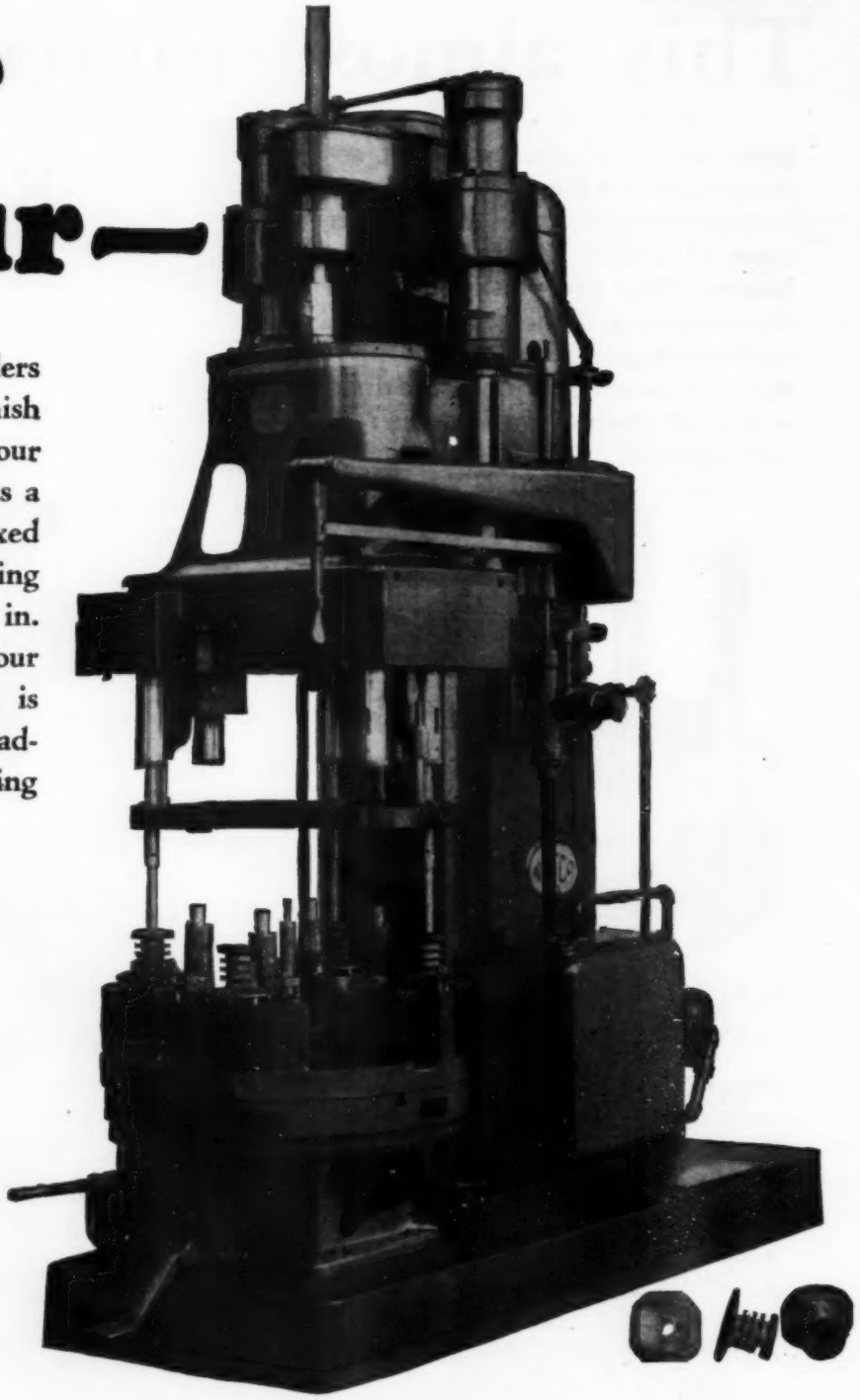
Pratt & Whitney Jig Borer

PRATT & WHITNEY COMPANY
Hartford, Connecticut
Division NILES-BEMENT-POND COMPANY

BIRMINGHAM, LOS ANGELES, BOSTON, PITTSBURGH, PHILADELPHIA, SAN FRANCISCO, ROCHESTER, DETROIT, NEW YORK, ST. LOUIS, CLEVELAND, CHICAGO, CINCINNATI

NATCO **MULTIPLE HYDRAULIC** NATCO

75 per hour—



75 Compressor Cylinders are rough bored, finish bored and reamed per hour on this machine. It has a hydraulic feed with a fixed center cluster box, boring a $1\frac{1}{2}$ in. dia. hole $3\frac{3}{4}$ in. deep in cast iron. A four position rotary table is used; there being one loading and three working positions.

"WE SOLVE YOUR 'HOLE' PROBLEMS"

LET US MAIL YOU A COMPLETE CIRCULAR

THE NATIONAL AUTOMATIC TOOL CO.

RICHMOND, INDIANA, U. S. A.

Announcement

IN order that a more complete and larger service may be given our customers, we have arranged to have sales of Bryant Grinders made through the following group of machine tool dealers.

It is not our intention to curtail or change the personnel of our present direct sales and service organization.

We feel sure the combination of our representatives with those of the Dealers will assure customers, past, present and future of the greatest attention and service possible.

Henry Prentiss & Co.	New York City Boston, Mass. Hartford, Conn. Syracuse, N. Y. Buffalo, N. Y.
W. E. Shipley Machinery Co.	Philadelphia, Penna.
Motch & Merryweather Machinery Co.	Cleveland, Ohio Pittsburgh, Penna. Detroit, Mich. Cincinnati, Ohio
Marshall & Huschart Machinery Co.	Chicago, Ill.
Marshall & Huschart Mchy. Company of Indiana	Indianapolis, Ind.
Robinson, Carey & Sands Co.	St. Paul, Minn.

For information write either to us or to the nearest dealer from above list.

BRYANT CHUCKING GRINDER COMPANY
Springfield, Vermont, U. S. A.

H. L. Bryant
President

MONARCH LATHES

ARE NOW OFFERED AS AN OPTIONAL EXTRA WITH SPINDLES MOUNTED IN PRECISION TYPE

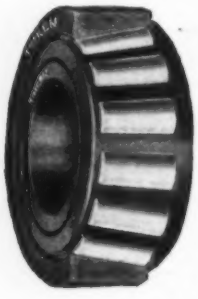
TIMKEN
Tapered
ROLLER BEARINGS

Spindle of Monarch Helical Geared Lathe equipped with Precision Timken Tapered Roller Bearings

To meet the increasing demand for anti-friction bearings, the Monarch line of helical geared head lathes from 14-in. to 30-in. sizes, inclusive, are now offered with spindles mounted in precision type Timken Tapered Roller Bearings, at prices slightly higher than when equipped with plain bearings.

We have been conducting tests on lathes in our own Experimental Department, thus equipped, and with highly satisfactory results. These bearings, being made to tolerance limits of .0002-in. insures accurate spindle alignment and it is reasonable to expect this accuracy to be retained indefinitely due to the ample reserve capacity in the bearings selected for each size of Lathe.

All end thrust of the spindle is taken against the front bearing. In fact in mounting the bearings an initial thrust load is imposed, thereby removing all radial as well as end movement of the spindle. Adjustment is provided for the bearings, but only very infrequent adjustment should be necessary.



On account of the fact that with a spindle mounted in plain bearings a film of oil between bearing and spindle is always necessary, while with the anti-friction bearing there is a metal-to-metal contact, accounts for the fact that it is possible to take heavier cuts without chatter or vibration than is possible with plain bearings.

The ease and quickness of replacement of a Timken bearing, should replacement ever be necessary, togther with the fact that the spindle never wears, and that after replacement the original accuracy or alignment is again restored, will appeal from a service standpoint.

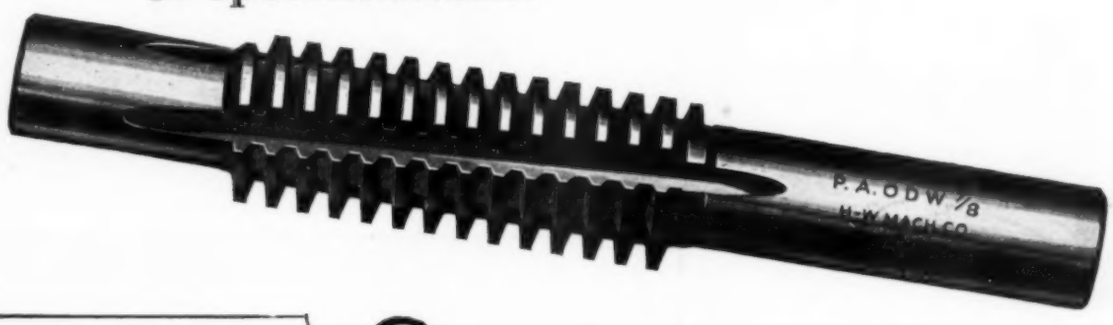
Clean filtered oil is supplied to both spindle bearings and their life should be indefinite. Bearings having ample radial and thrust capacity, are selected for each size of Lathe.

THE MONARCH MACHINE TOOL COMPANY
SIDNEY, OHIO, U. S. A.
NEW YORK OFFICE: 857 GRAYBAR BUILDING

"Hanson-Process" Gear Hobs (corrected after hardening) produce their own true counterpart—perfect, silent, smooth-running gears.

Such hobs can be used full length, which means they deliver much more service than the ordinary Hob. Removal of the burned "skin" in the correcting process, assures a keen-cutting edge that stands up longer between grinds.

They never fail to justify their slightly higher cost. Prices cheerfully quoted upon receipt of prints or specifications.



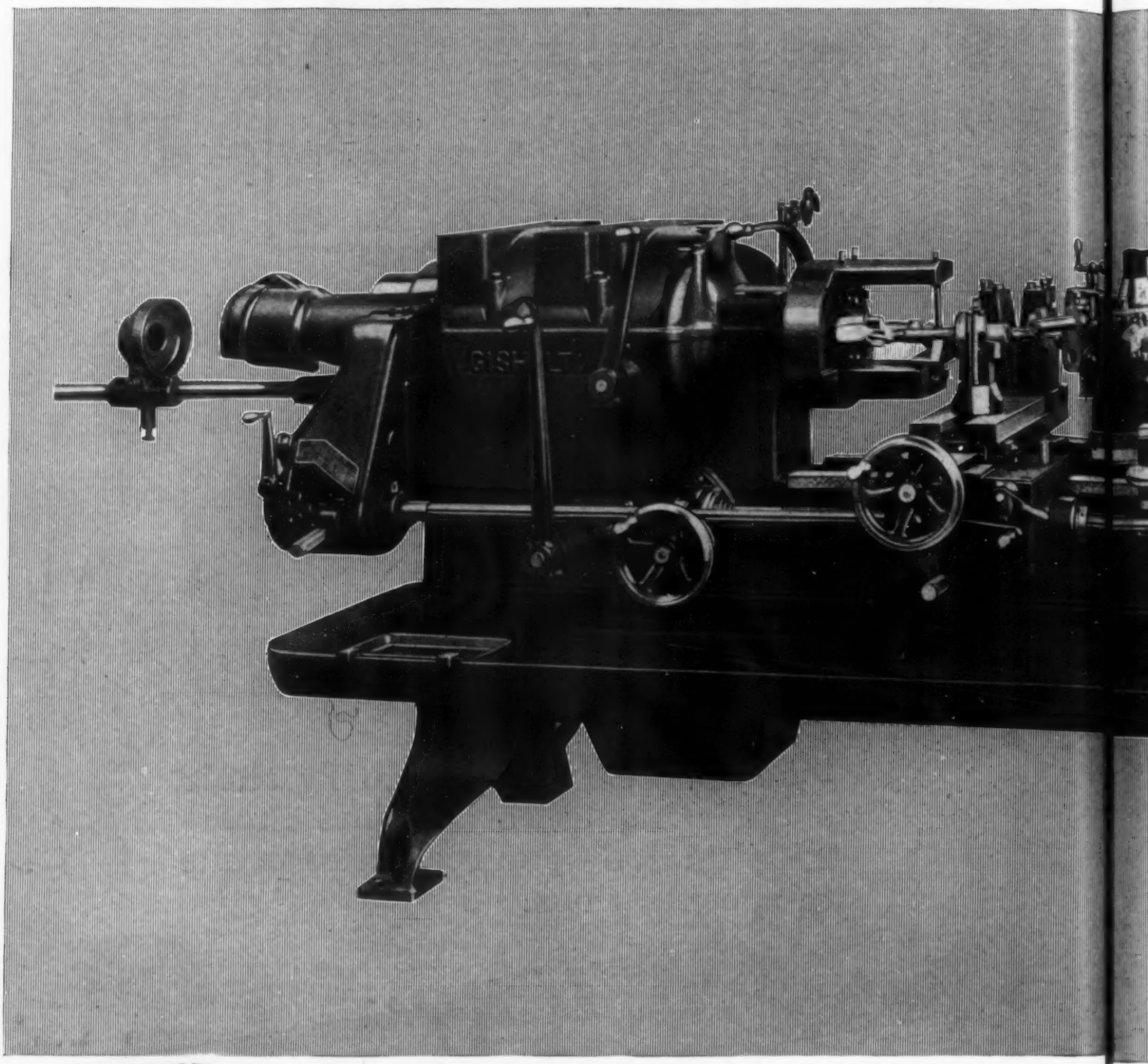
DOMESTIC REPRESENTATIVES

New York, N. Y., L. C. Biglow & Co., Inc., Syracuse, N. Y., George McPherson; Boston, Mass.; George C. Steil; Philadelphia, Pa., D. J. Normoyle; Pittsburgh, Pa., William K. Stamets; Cleveland, Ohio, William K. Stamets; Cincinnati, Ohio, Seifreat-Elstad Mchy. Co.; Dayton, Ohio, Seifreat-Elstad Mchy. Co.; Detroit, Mich., A. G. Brice; San Francisco, Calif., A. H. Coates Co.; Chicago, Ill., E. H. Huntington; Toronto, Ont., Canada, Arthur Jackson.

The Hanson-Whitney Machine Company

Hartford, Conn., U.S.A.

GISHOLT Small



GISHOLT

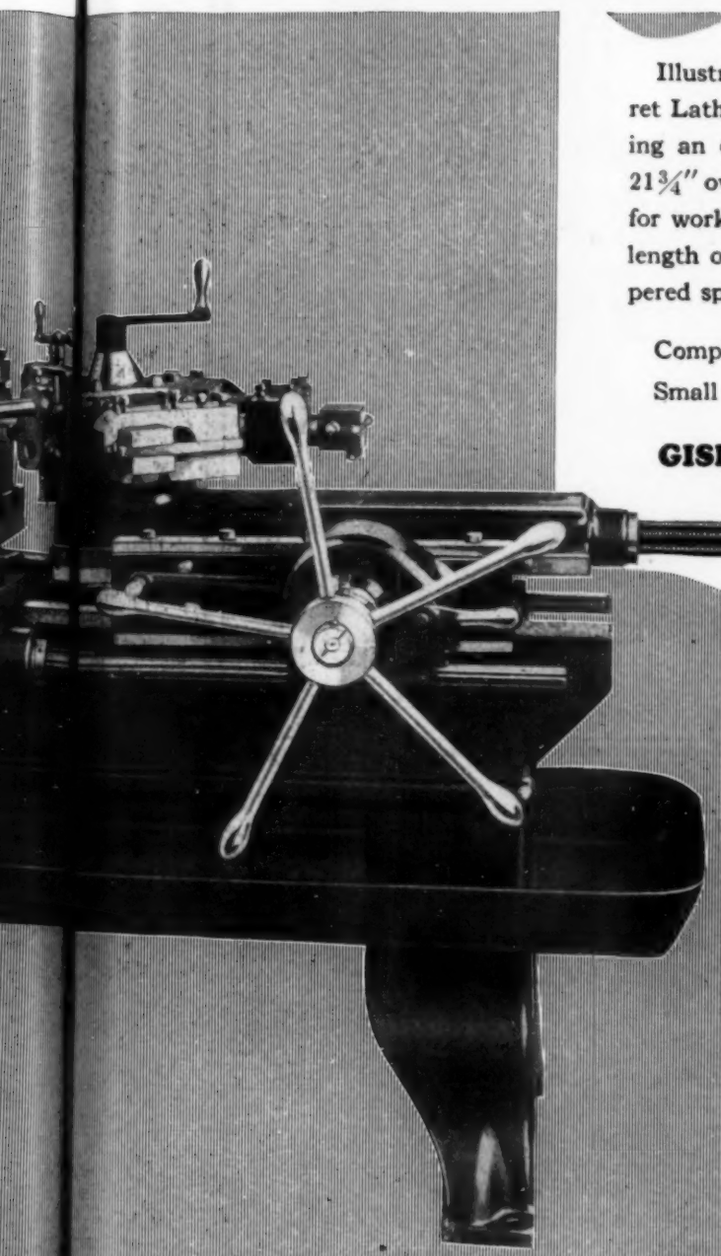
TO INCREASE

Machine Design Service

Tool Design Service

Field Production Service

Turret Lathes



Illustrated is a No. 6 Geared Head Small Turret Lathe with special chucking fixture machining an oil pump body. This machine swings 21¾″ over ways, 11″ over cross slide; is splendid for work requiring chucking fixtures of unusual length or swing, with ways 58¼″ long and tapered spindle nose.

Complete details of this line in the Gisholt Small Turret Lathe book, mailed on request.

GISHOLT MACHINE COMPANY
Madison, Wisconsin, U. S. A.

YOUR CHUCKING PROFITS

Heavy Turret Lathes | **Small Turret Lathes** | **Automatic Chucking Machines** | **Balancing Machines** | **Tool Grinders**

PERFECT OILING

Long life and freedom from wear can be secured only by adequate and unfailing lubrication. The following features, incorporated in *Gray Maximum Service Planers,* are therefore of the utmost importance:

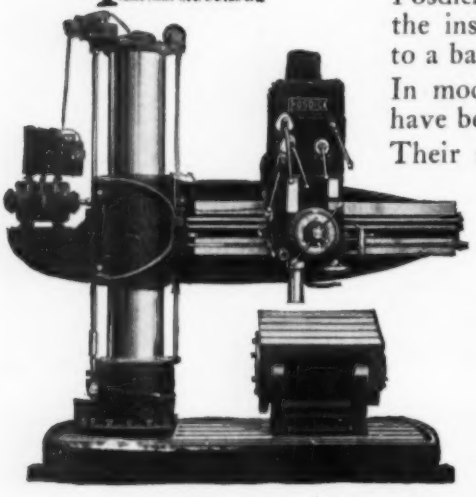
1st. V's are flooded with filtered oil.
2nd. Gears run in a bath of oil.
3rd. Driving shaft bearings are flooded with filtered oil.
4th. Gray Pressure Relief Valve maintains constant oil pressures.
5th. Feed and rapid traverse gears run in oil.
6th. Rail, side-heads and top works are lubricated from centralized oil reservoirs.

Let us tell you of the many *other features* that make Gray Maximum Service Planers so easy to take care of and such big producers.

THE G. A. GRAY CO.
CINCINNATI, OHIO

Standard Equipment

FOSDICK



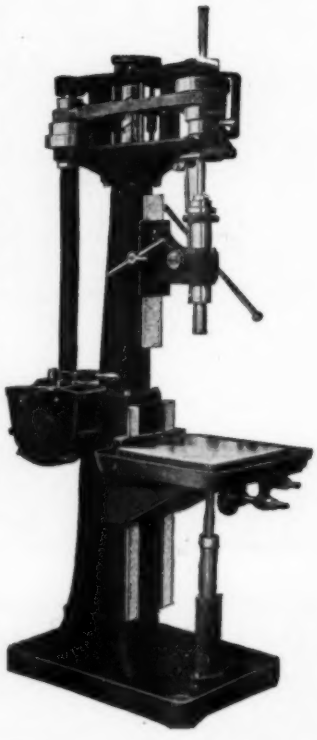
The performance of Fosdick Ball Bearing Sensitive Upright Drilling Machines and Fosdick Radials is of such a superior order that the installation of a single unit usually leads to a battery.

In modern plants Fosdick Drilling Machines have been adopted as standard equipment.

Their smooth performance, easy control and the rapidity with which accurate adjustments can be made have won them a firm place in plants where high quality work prevails.

Their adaptability suits them for the plants where variety operations must be performed in minimum time.

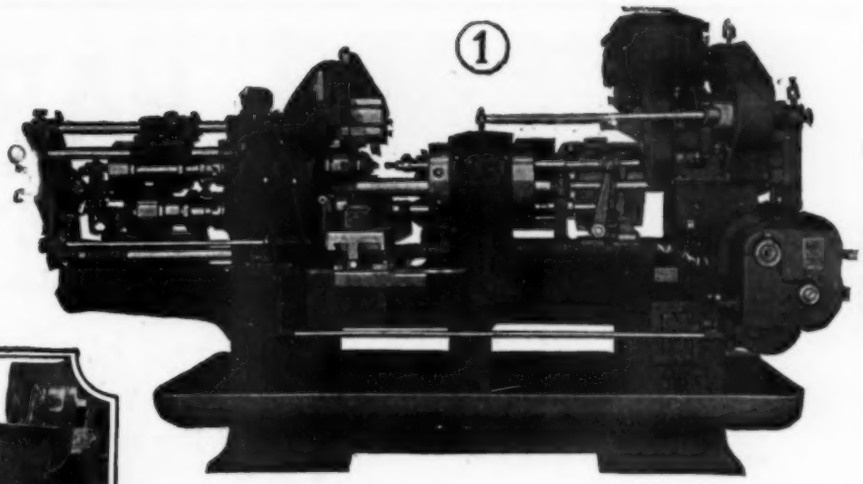
The Fosdick Line is fully detailed in our Catalog, a copy of which we shall be glad to mail you.

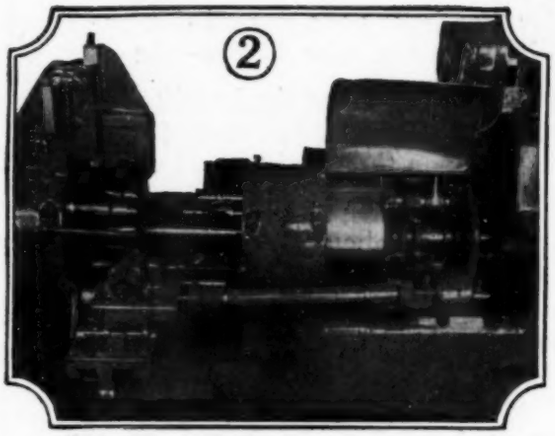


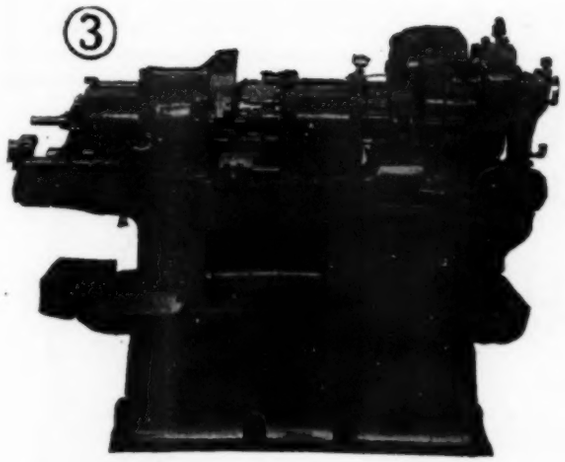
The Fosdick Machine Tool Company

Cincinnati, Ohio, U. S. A.

AGENTS: Colcord-Wright Machinery & Supply Co., St. Louis, Mo.; The Mine & Smelter Supply Co., Salt Lake City, Utah; Moore-Handley Hdwe. Co., Birmingham, Ala.; C. F. Bulotti Mchy. Co., San Francisco, Calif.; Eccles & Davies, Los Angeles, Calif.; M. A. Wertman Mchy. Co., Cleeveland, Ohio; Bay Verte Mchry. Supply Co., Green Bay, Wis.; Barbour, Love & Woodward, New York, N. Y.; E. A. Kinsey Co., Cincinnati, Ohio; Indianapolis, Ind.; Peninsular Machinery Co., Detroit, Mich.; Homer Strong, Rochester, N. Y., Buffalo, N. Y.; H. A. Smith Machinery Co., Syracuse, N. Y.; Swind Mchry. Co., Philadelphia, Pa.; Somers, Fitler & Todd Co., Pittsburgh, Pa.; Stocker-Rumely-Wachs Mchry. Co.; Chicago, Ill.; Milwaukee, Wis.; Brownell Mchy. Co., Providence, R. I.; A. R. Williams Mchry. Co., Toronto, Ont., Can.; Burton, Griffiths & Co., London, England; Fenwick, Freres & Co., Paris, France; Wynmalen & Haustman, Rotterdam, Holland; Rylander & Asplund, Stockholm, Sweden.







3 Developments in "CLEVELANDS"

IN solving the highly specialized machine problems of our patrons we have developed (1) a particularly meritorious 4 spindle chucking machine with $4\frac{1}{2}''$ or $5\frac{1}{2}''$ chucking capacity and a total of eight tool positions. Tooling is particularly adaptable with independent rotation of all turret tool positions. All chucks are controlled by a single patented Cleveland air valve or by mechanical control with control lever conveniently located. Magazine feed is also optional.

Worms are now generated on any Cleveland spindle bar machine by means of (2) a newly patented Cleveland worm generating attachment which takes the place of a front tool slide. Avoid expensive and slow hobbing operations by turning out small spiral parts on this device at the rate of 100 or more per hour, in no more time than it now takes to blank them.

For rapid production of small brass, bronze or steel parts with a large number of cuts, you will find (3) the new 5 spindle bar $\frac{1}{2}''$ Cleveland a revelation of speed, adaptability and low production cost over a long period of time.

CLEVELAND AUTOMATICS

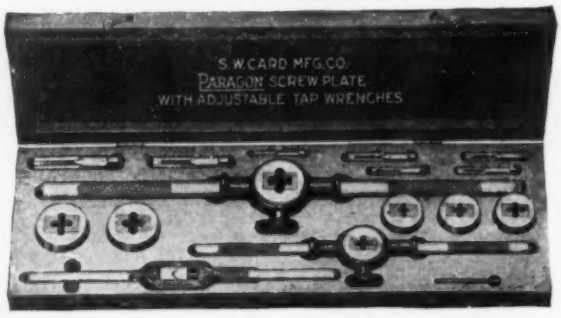
Let Cleveland Automatics solve your production problems

THE CLEVELAND AUTOMATIC MACHINE CO.
Cleveland, Ohio, U. S. A.

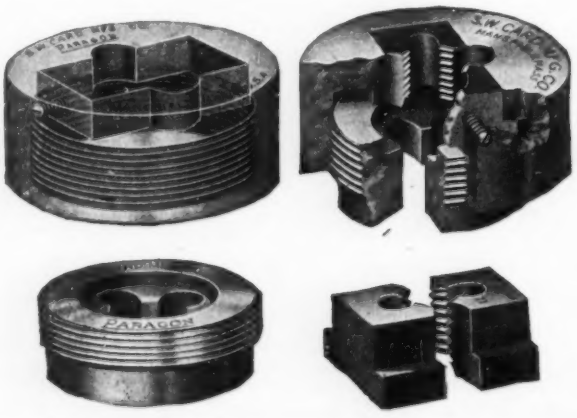
NEW YORK
95 Liberty Street

CHICAGO
565 W. Washington Boulevard

DETROIT
1217 Book Building



Various parts of the Paragon die are shown. See how easily they can be removed for grinding; and the long bearing which assures true alignment. Note how these dies are designed to cut threads close to a shoulder.



PARAGON

SCREW PLATES

are designed and built to be leaders in their field.

How far they have gone toward that end is best voiced by one who knows—the user.

For example:—"During the last 40 years I have used practically every make of die and have found none that could equal the performance of CARD Paragon Dies."

Let us tell you all about the Paragon Screw Plate and others which make up the complete CARD Line. Write for a copy of Catalog No. 31.

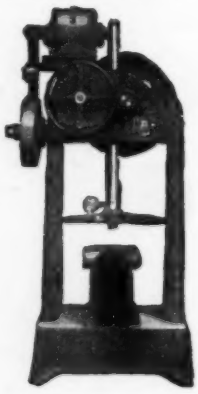
S.W. CARD MFG. CO.
DIVISION OF UNION TWIST DRILL CO.
MANSFIELD, MASSACHUSETTS, U.S.A.

GREATER RETURNS ON CAPITAL

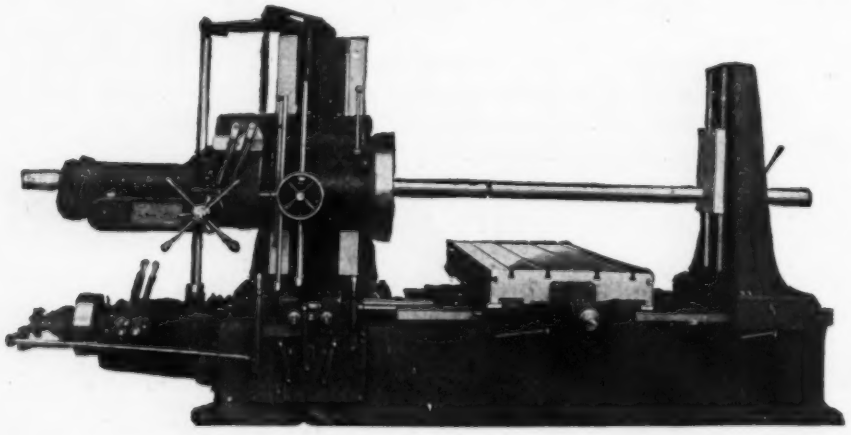
can be obtained by investing in the

Lucas "Precision"

Horizontal Boring, Drilling and Milling Machine



and



LUCAS Power Forcing Press,

than by taking earnings out of your business and reinvesting elsewhere.

THE LUCAS MACHINE TOOL CO., Cleveland, Ohio

Another New "Norton"—
A Hydraulic Surface Grinding Machine

for production grinding of small parts or for general tool room use—a simple, accurate, productive machine.

Two Sizes

6 in. x 10 in. x 36 in.
6 in. x 10 in. x 48 in.

NORTON COMPANY
Worcester, Mass.

New York Detroit
Chicago Philadelphia
Cleveland Hartford
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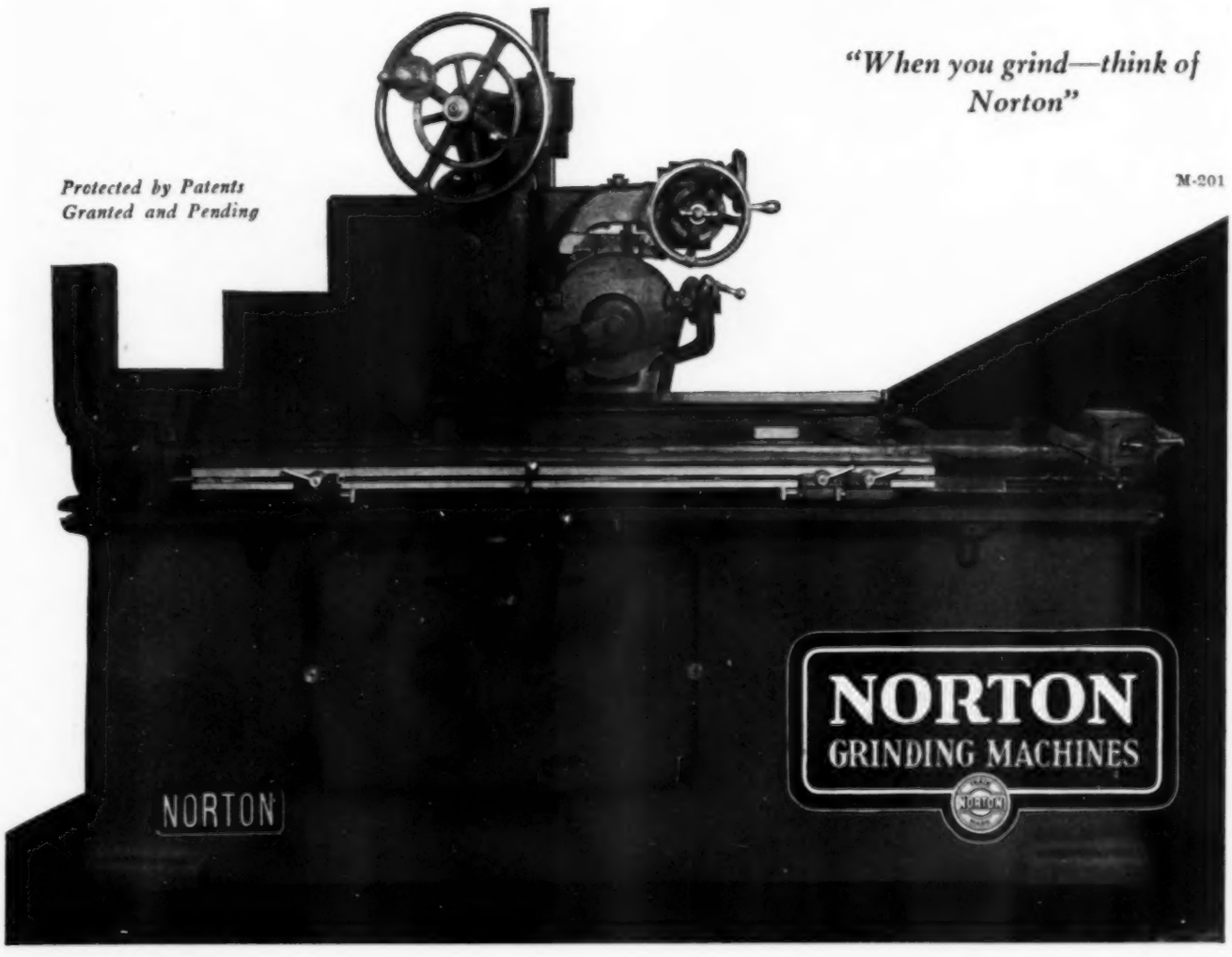
"When you grind—think of Norton"

Protected by Patents Granted and Pending

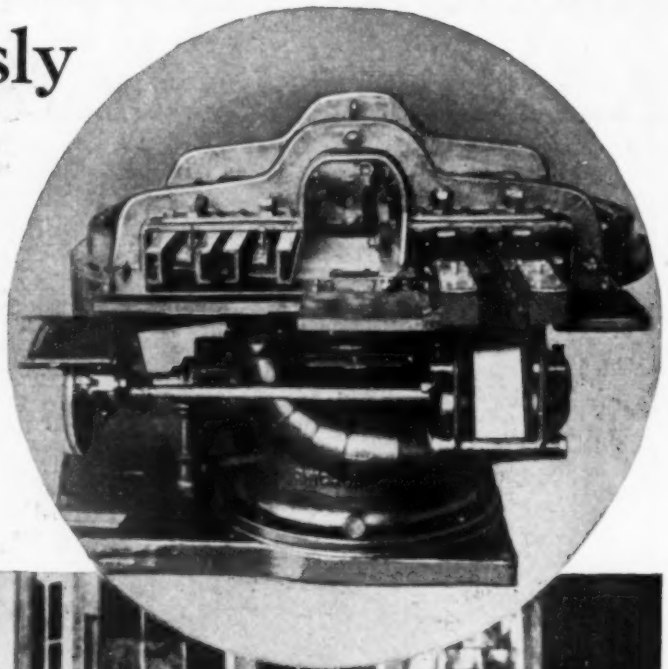
M-201

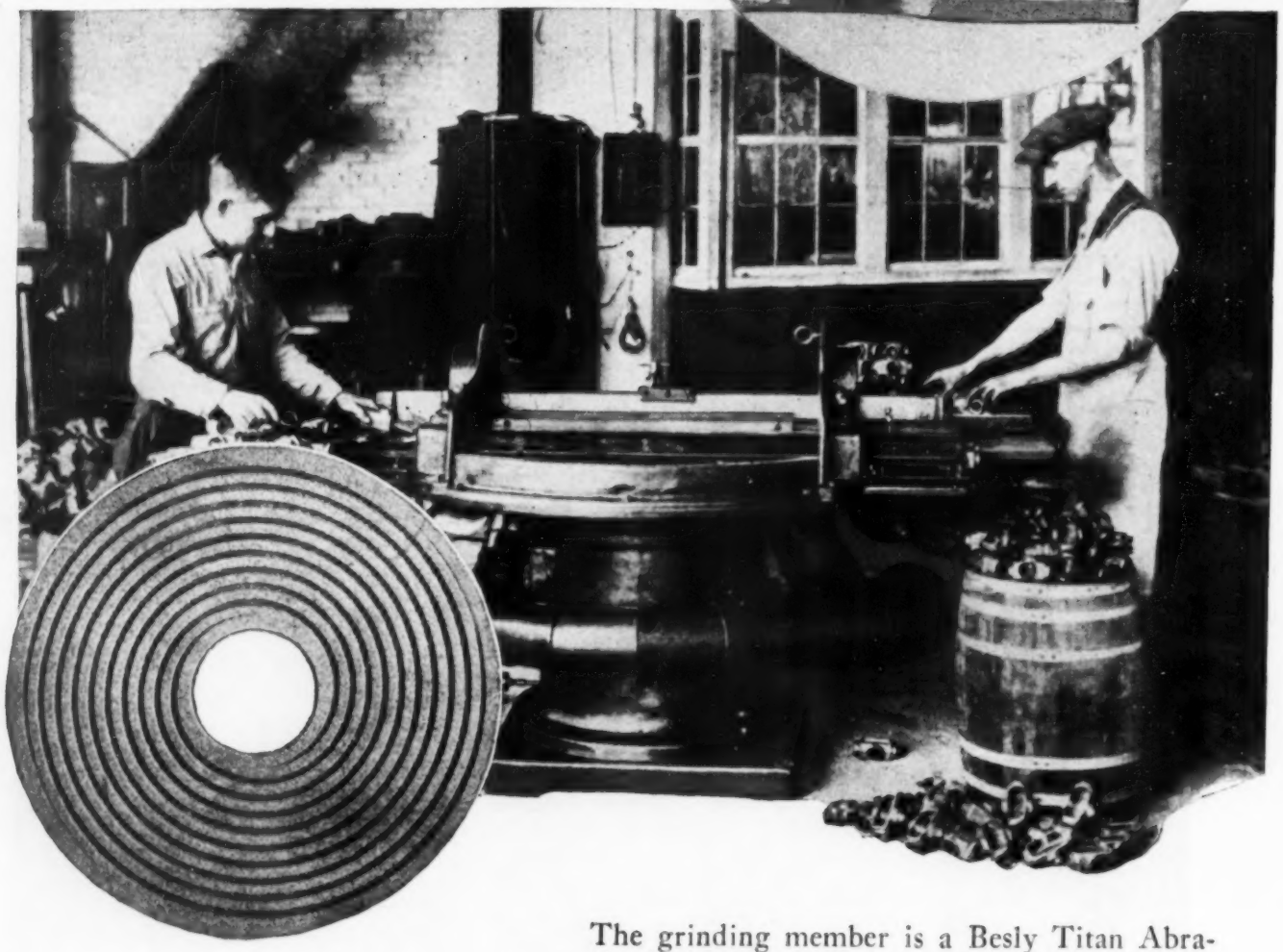


7200 Conduit Boxes Per Hour!

Ground on the Besly Vertical Spindle Disc Grinder

With two operators feeding the work this Besly Vertical Spindle Motor Driven Disc Grinder grinds off fins and irregularities from Conduit Boxes at the rate of 7200 boxes per hour. Boxes are handled direct from the foundry—the Besly produces a level, flat surface where cover plate is attached.





The Besly-Titan Spiral Abrasive Disc

(PATENT APPLIED FOR)

The use of Besly Titan Abrasive Discs (heavy cement bond discs, made entirely of abrasive grain with minimum amount of bond), set up with Redisc Cement is a radically new development in the art of disc grinding. No more stopping the machine every few hours to replace abrasive discs. No more waiting days for liquid cements to dry out. Write today for new booklet.

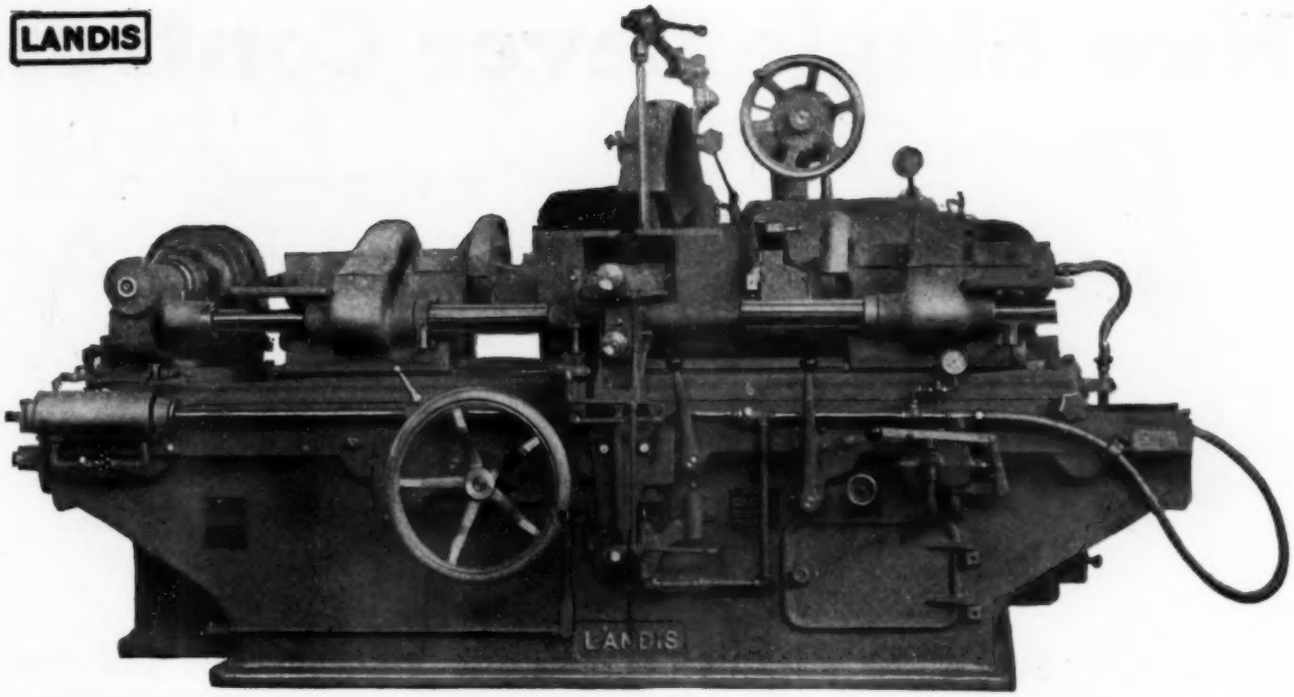
The grinding member is a Besly Titan Abrasive Disc 53 in. diameter by 3/8 in. thick.

Let us help you in procuring a flat surface grinding machine to meet your specific needs to grind fast—accurate—at low cost.

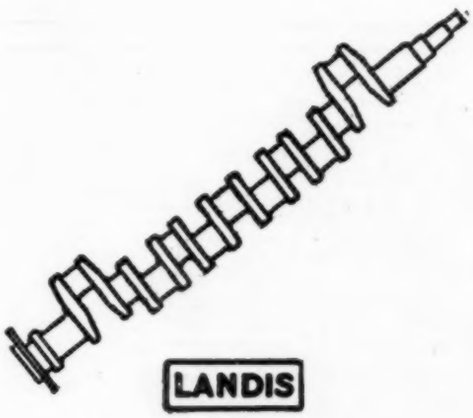
Charles H. Besly & Company

118 No. Clinton St., Chicago, Ill.

LANDIS



Insured Performance



LANDIS

Hydraulically Operated Crank Pin Grinding Machine

THIS applies equally to both accuracy and production, and both are found to the fullest extent in the LANDIS Hydraulic Crank Pin Grinder.

Its close accuracy is due, primarily, to the unusually rigid design. There are also a number of other new and important features that insure precision by eliminating the human element in grinding automobile, airplane and other gas engine crankshafts.

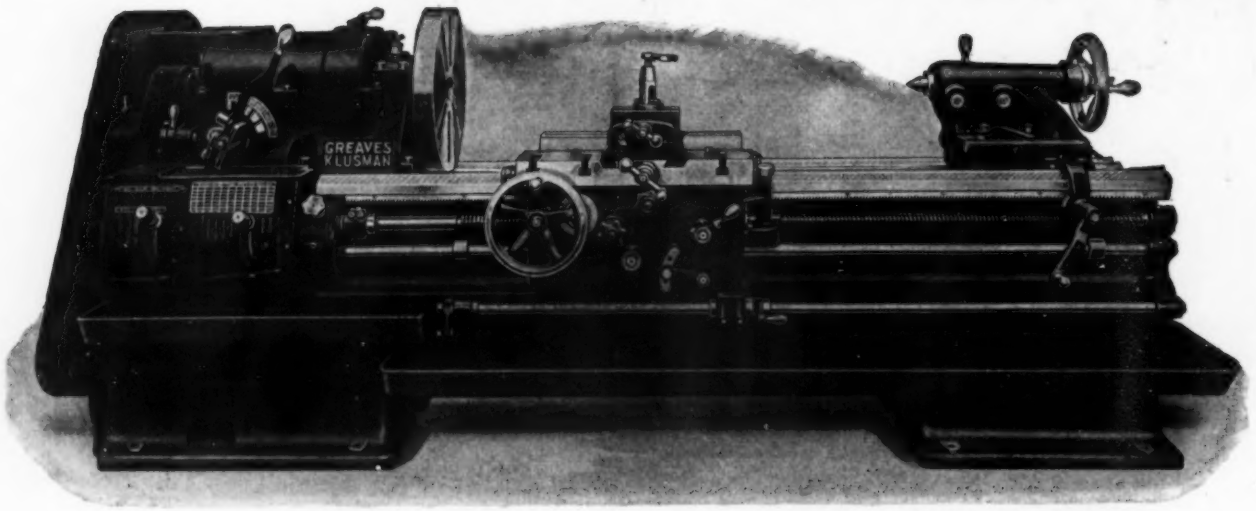
Hydraulic power—easily controlled, smoothly and quickly delivered—operates the work carriage, wheel feed, work clamps and work rest.

The stationary hydraulic work rest, the indexing fixture, the spacing device, the locating arrangement are all worthy of your notice for their use makes it possible to *grind all the pins of a crankshaft without removing it from the machine.*

LANDIS TOOL CO., Waynesboro, Pa.

NEW YORK OFFICE: 2907 Singer Bldg.
CHICAGO OFFICE: 618 W. Washington Blvd.
DETROIT OFFICE: 5928 Second Blvd.

New Single Lever Control



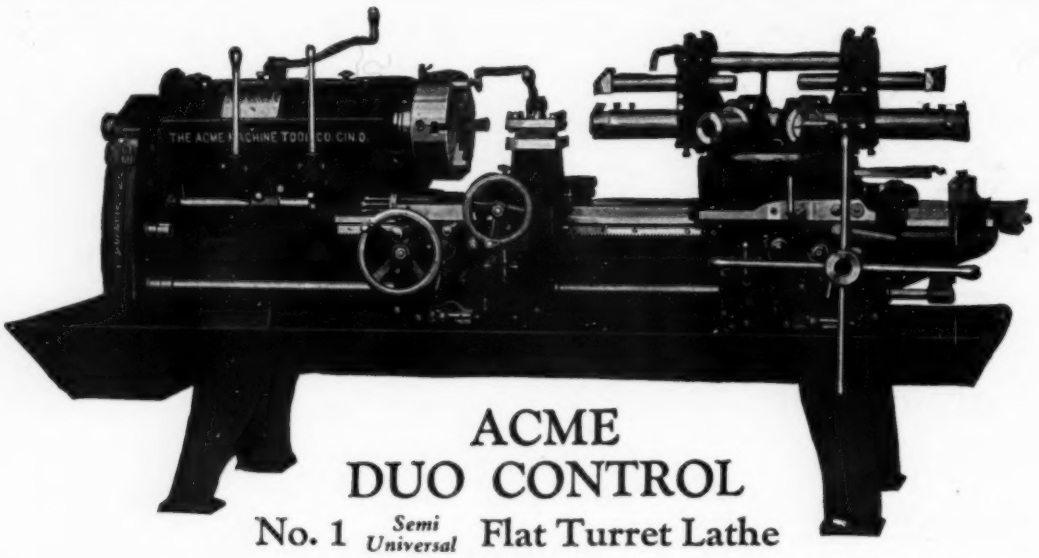
ONE lever for all spindle speeds is the feature that makes G-K Single Lever Control Heavy Duty Lathes favorites of operators.

It is only necessary to move one lever to get any desired speed. An index plate shows at a glance how to obtain the combination.

There are many other features in G-K Lathes that promote output and thus cut costs.

We detail them all in the Catalog.

The Greaves-Klusman Tool Co., Cincinnati, Ohio



ACME DUO CONTROL

No. 1 *Semi Universal* Flat Turret Lathe

Produces *more* with *less* effort, due to the following features

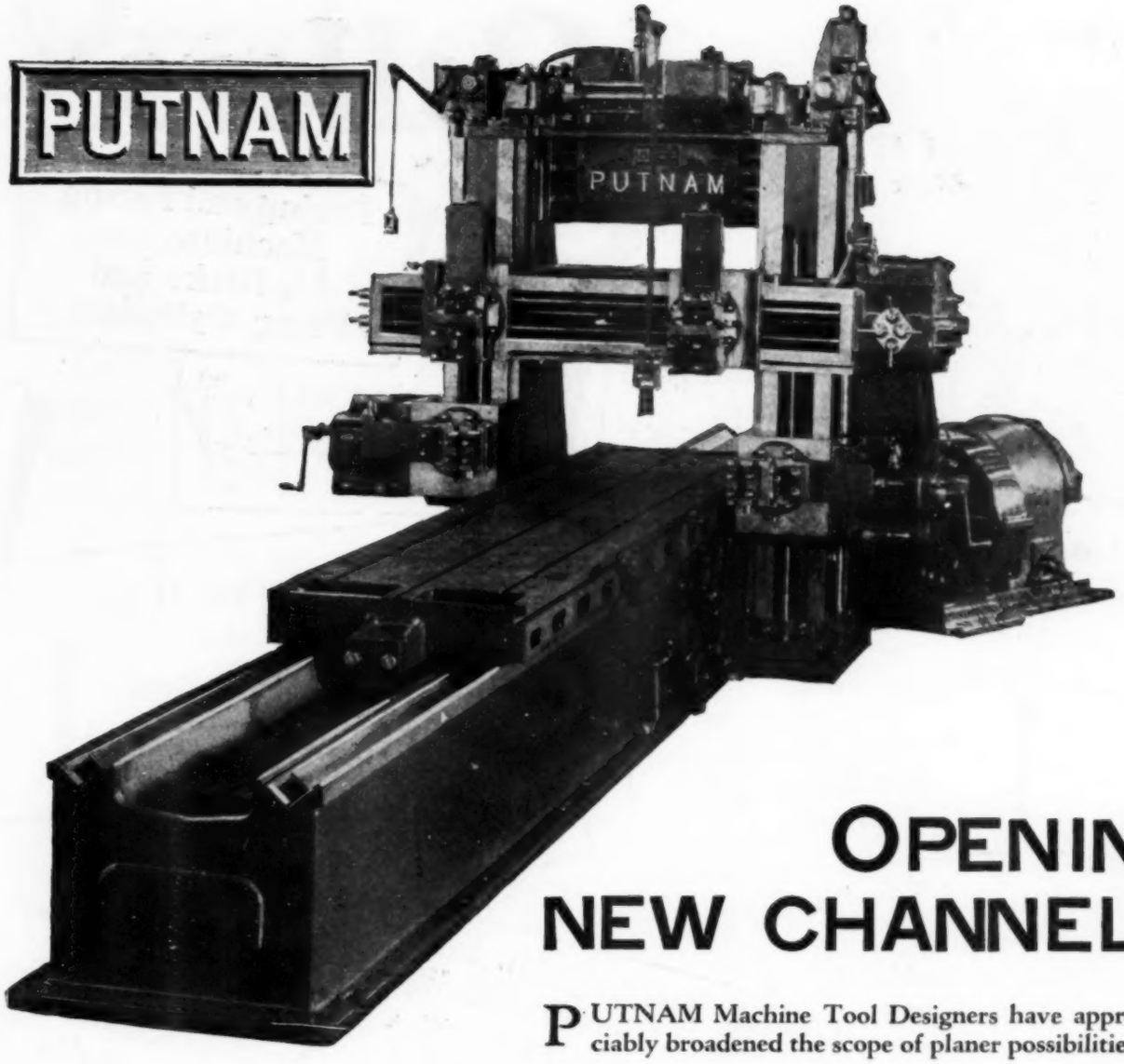
Patented all-geared head.
Oil-hardened alloy steel gears.
All feed changes in apron.
Foolproof speed shift.
Rapid power traverse.
Instantaneous speed shift.
Automatically disengaged clutch.
Wide range of feeds and speeds.

All operating levers conveniently positioned. Chucking and Bar equipment interchangeable.

Write for Catalog and further details.

Acme Machine Tool Co., 4955 Spring Grove Ave., Cincinnati, Ohio

PUTNAM



OPENING NEW CHANNELS

PUTNAM Machine Tool Designers have appreciably broadened the scope of planer possibilities.

In design, the Putnam Planer is not radical, yet the flexibility of its tool heads permits of tool set-ups for simultaneous operations that elevates Putnam Planers to the production milling machine class.

Putnam Engineers can show you how easily you can broaden the scope of your planer department.

We would welcome an opportunity to discuss multi-surface planing with you.

SHAW CRANE-PUTNAM MACHINE CO. INC.

PUTNAM WORKS — FITCHBURG, MASS.

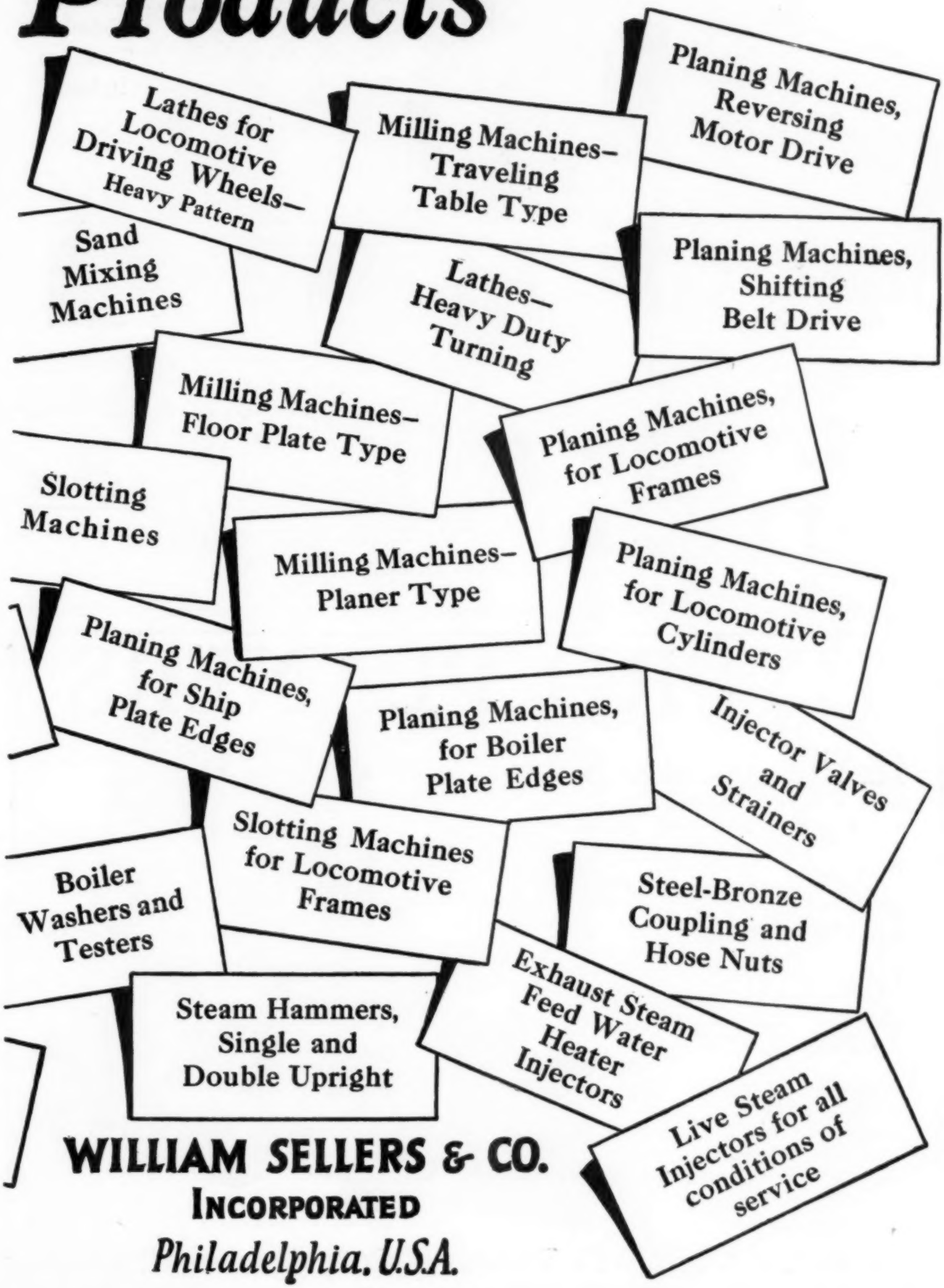
Ownership of: MANNING, MAXWELL & MOORE, Inc.
General Offices: 100 EAST 42d STREET, NEW YORK CITY

Planers—Open Side, Convertible, Double Housing. Horizontal Boring, Milling and Drilling Machines. Special Production Tools for boring, facing and milling. Heavy Duty Machine Tools for Industrial and Railroad Service.

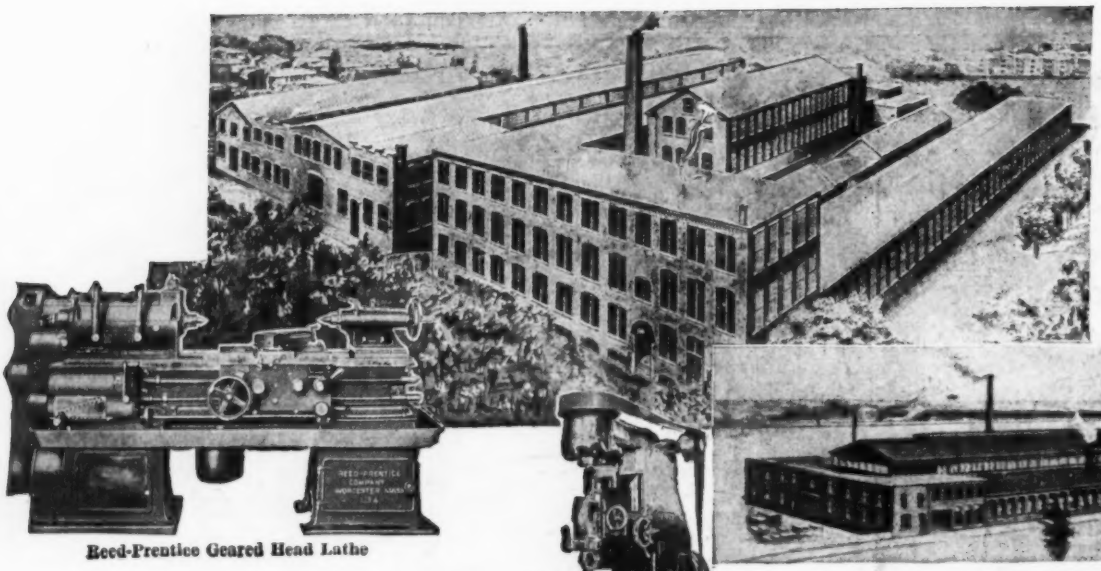
Also Manufacturers of Shaw Electric Cranes—Works, Muskegon, Mich

Sellers
Boring and Facing Machines for Air Brake and Pump Cylinders
Boring and Drilling Machines —Portable
Boring and Turning Mills
Boring Machines for Connecting Rods
Boring and Turning Mills for Steel Tires
Boring Mills for Car Wheels
Boring Machines for Driving Boxes
Boring Mills with power facing arm for Car Wheels
Boring and Facing Machines for Locomotive Cylinders
Drilling Machines —Traverse Radial, with two or more arms
Drilling Machines— for Rails
Drilling Machines— Multiple
Lathes for Turning Axles
Grinding and Pointing Machines for Drills
Grinding and Shaping Machines for Tools
Drilling Machines— Horizontal
Drilling Machines— Radial
Lathes for Locomotive Driving Wheels
Lathes for Car Wheels
Boring, Drilling and Milling Machines, 4 to 10" Spindle

Products


Lathes for Locomotive Driving Wheels– Heavy Pattern
Milling Machines– Traveling Table Type
Planing Machines, Reversing Motor Drive
Sand Mixing Machines
Lathes– Heavy Duty Turning
Planing Machines, Shifting Belt Drive
Milling Machines– Floor Plate Type
Planing Machines, for Locomotive Frames
Slotting Machines
Milling Machines– Planer Type
Planing Machines, for Locomotive Cylinders
Planing Machines, for Ship Plate Edges
Planing Machines, for Boiler Plate Edges
Injector Valves and Strainers
Slotting Machines for Locomotive Frames
Boiler Washers and Testers
Steel-Bronze Coupling and Hose Nuts
Exhaust Steam Feed Water Heater Injectors
Steam Hammers, Single and Double Upright
Live Steam Injectors for all conditions of service

WILLIAM SELLERS & CO.
INCORPORATED
Philadelphia. U.S.A.



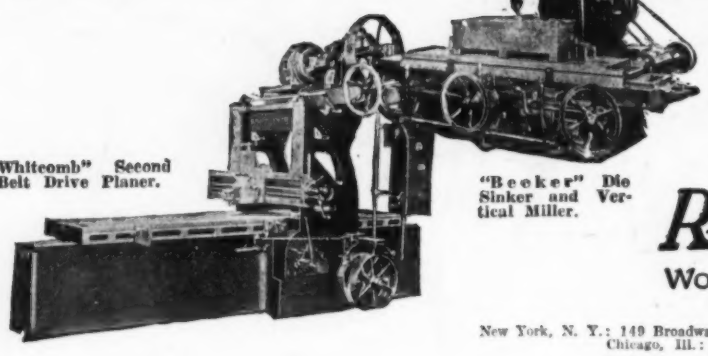
Reed-Prentice Geared Head Lathe

76 Years
a builder of
"Master
Tools" of
Industry

Foundry Division

Since 1849, over three-quarters of a century, the companies of which Reed-Prentice is the outgrowth have been designing and constructing machine tool equipment.

REED-PRENTICE Lathes, BECKER Die Sinking and Vertical Milling Machines and WHITCOMB Second Belt Drive Planers are known the world over for their high quality, accuracy and durability.



"Whitcomb" Second Belt Drive Planer.

"Becker" Die Sinker and Vertical Miller.

MACHINE TOOLS

REED-PRENTICE CORP.

WORCESTER MASS. U.S.A.

Branch Offices:
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Chicago, Ill.: Federal Machinery Sales Co., 17 So. Jefferson St.
Representatives throughout the World

HYPRO PLANERS

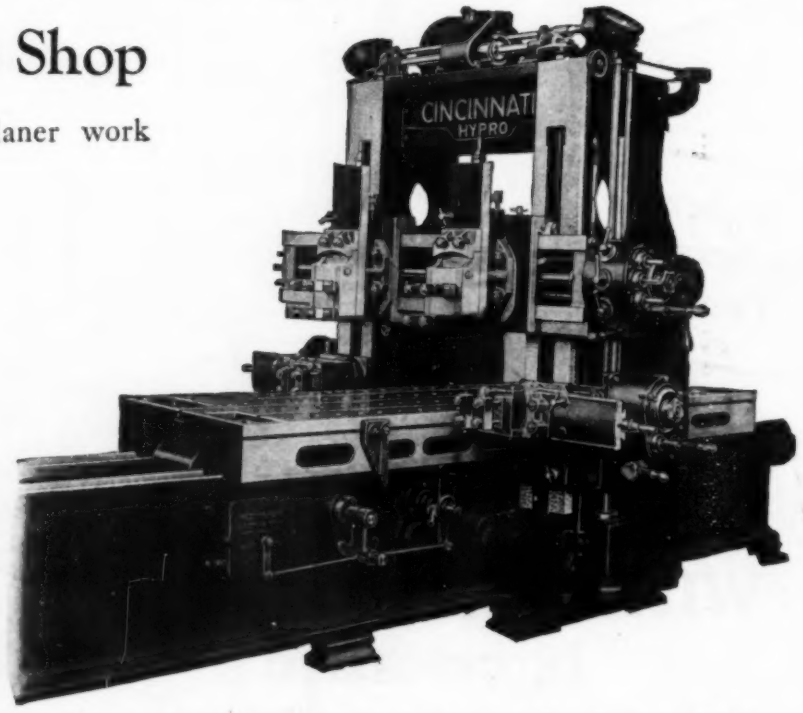
In the Average Shop

one will find long-reach planer work

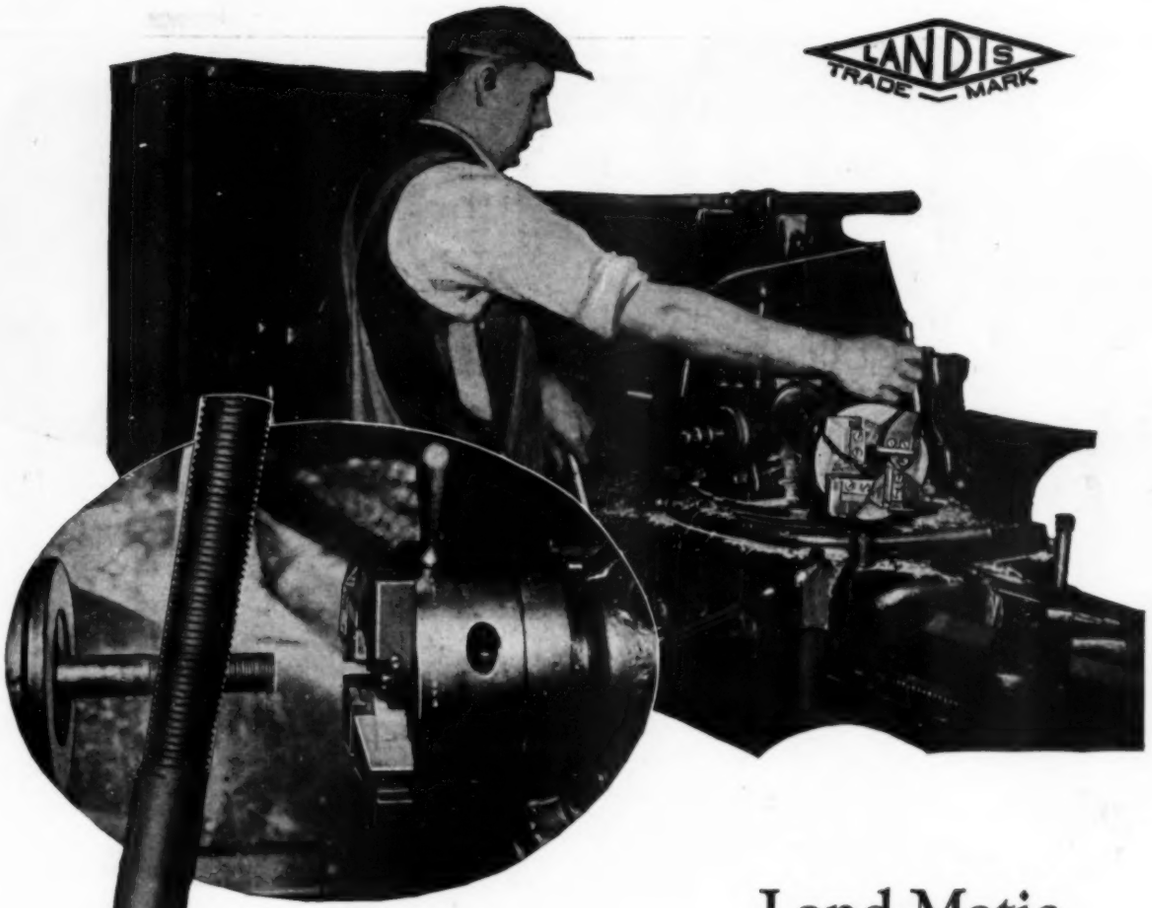
With our

Long Slide Inverted Dove Tail

design you can take extremely large cuts when reaching far below the rail. The side heads have the same slide construction Taper gibs throughout maintain accuracy.



THE CINCINNATI PLANER CO., Cincinnati, Ohio



Land-Matic
Eliminates a Threading Operation
and Cuts a Better Thread

An important threading job—pusher rods for Taylor Stokers linked up with a lot of trouble in threading it! Such was the combination that brought grief to the production men in the plant of the American Engineering Co., Philadelphia. That was eight months ago—today a Land-Matic Die Head is used, and trouble is now past history.

The pusher rod shown here has a 1¾ in.-5 thread 10⅛ in. long, and it formerly required two dies on a turret lathe to cut the thread. Two operations! That alone wouldn't have been so bad because this thread must fit well in a tapped hole, and a good job is required—but even at that the chasers choked with chips and tore the threads. Now this Land-Matic Die Head cuts the thread in one operation in 2½ minutes. It never chokes; it never tears; it cuts as smooth a thread as any critical inspector would care to see.

Let Land-Matics do *your* threading. Their straight line chasers will help your production.

LANDIS MACHINE COMPANY, Inc., Waynesboro, Penna.

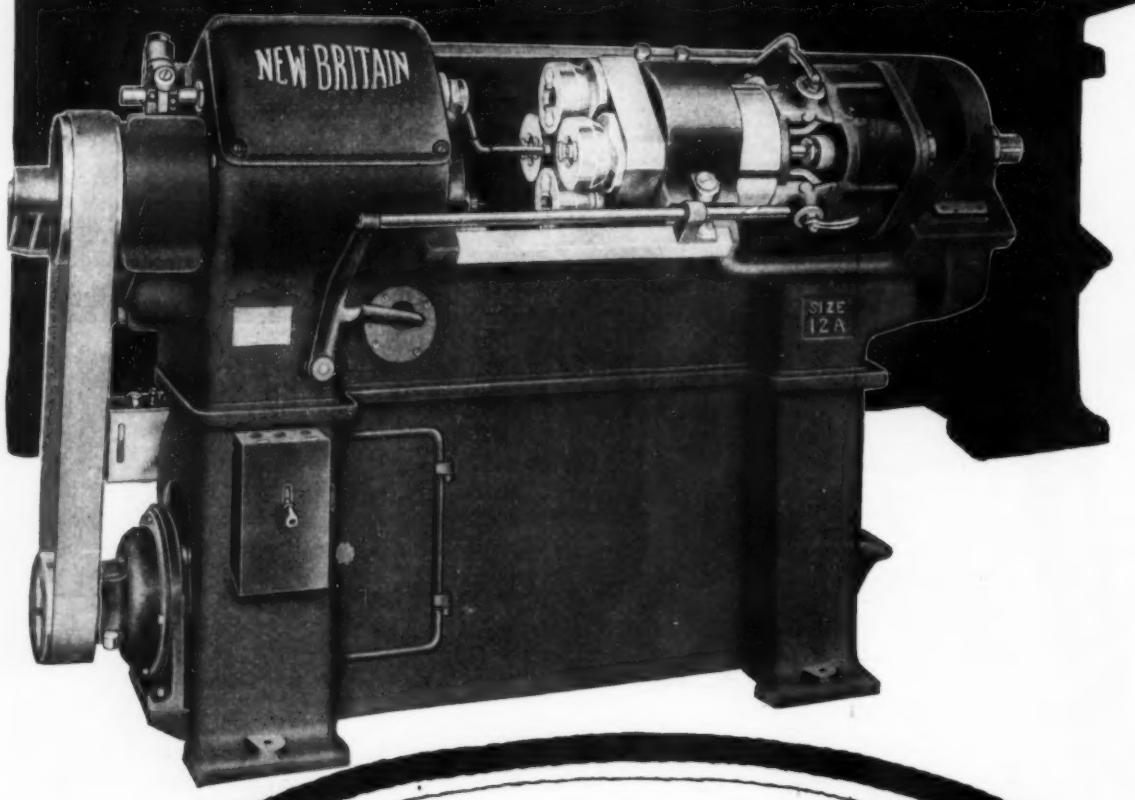
Detroit Office: 5829 Second Blvd.

DOMESTIC AGENTS: Marshall & Huschart Machinery Co., Chicago, Ill.; Marshall & Huschart Machinery Co., of Indiana, Indianapolis, Ind.; Colcord-Wright Machinery & Supply Co., St. Louis, Mo.; R. B. Whitacre & Co., St. Paul, Minn.; Hamilton Machinery Co., Chattanooga, Tenn.; Young & Vann Supply Co., Birmingham, Ala.; Woodward, Wight & Co., New Orleans, La.; Jos T. Ryerson & Son, Houston, Texas; Hendrie & Bolthoff Mfg. & Supply Co., Denver, Colo.; Salt Lake Hardware Co., Salt Lake City, Utah; Herberts Machinery & Supply Co., San Francisco and Los Angeles, Calif.; Harry M. Euler Co., Portland, Ore.; Hallidie Mchy. Co., Seattle, Wash.; Hallidie Co., Spokane, Wash.

CANADIAN AGENTS: Canadian Fairbanks-Morse Co., Toronto, and Montreal.

FOREIGN AGENTS: Benson Brothers, Ltd., Sydney; Schuchardt & Schutte, Berlin, Vienna; R. S. Stokvis & Zonen, Rotterdam, Brussels; M. Almeida & Cia, Sao Paulo, Rio de Janeiro; Burton Fils, Paris, D. Drury & Co., Johannesburg; C. A. Herstad, Copenhagen; Ing. Ercole Vaghi, Milan; Allied Machinery Co., Barcelona, Zurich; Akt. Axel Christernsson, Stockholm; Burton Griffiths & Co., London; Horne Co., Ltd., Osaka; Thos. Robinson & Son, Ltd., Calcutta.

SUPER-PRODUCTION

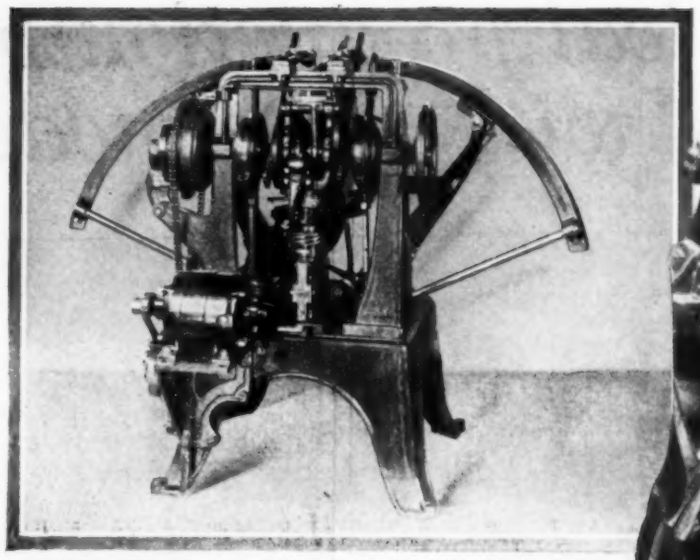


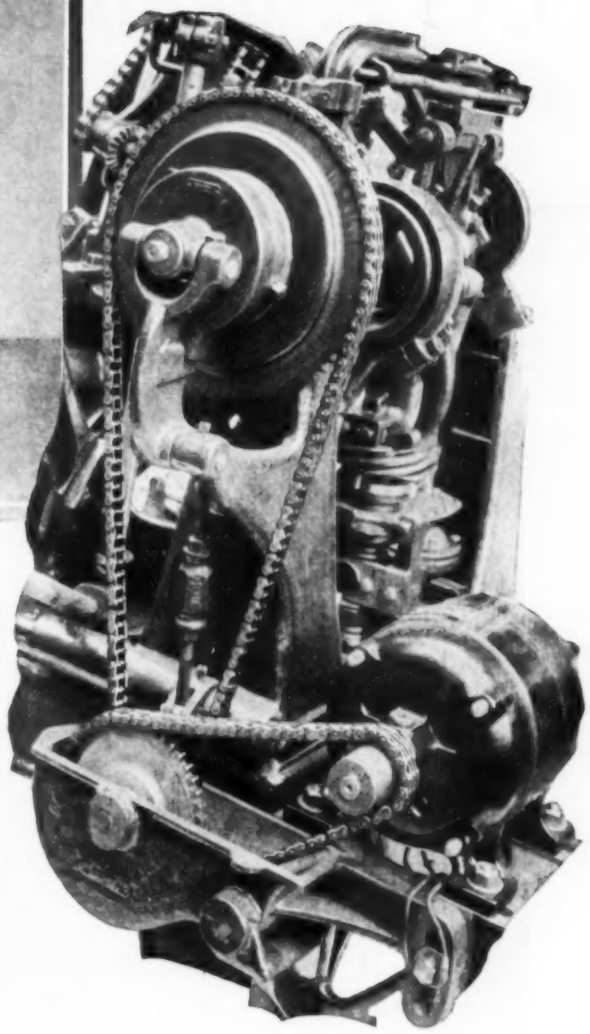
New Britain Leads the Way—

to Super-Economy through Super-Production. And this super-economy comes not alone from greater quantities but also from a higher quality of parts produced. This applies to the complete line of New Britain Automatics.

"NEW BRITAIN" NB AUTOMATICS

The New Britain Machine Co.
New Britain, Conn.





"To meet the demand for motor drive—"

That is the reason given by the manufacturer* of this machine for adopting "WHITNEY" Silent Chain as standard drive equipment. The report goes on to state that the change from belt drive made about a year ago has met with a most gratifying reception from customers.

There is a "WHITNEY" Chain for practically any power transmission to which chains are adaptable.

Let our nearest engineering representative submit you a proposition to cover your individual requirements.

*Name on application.

THE WHITNEY MFG. CO., Hartford, Conn.

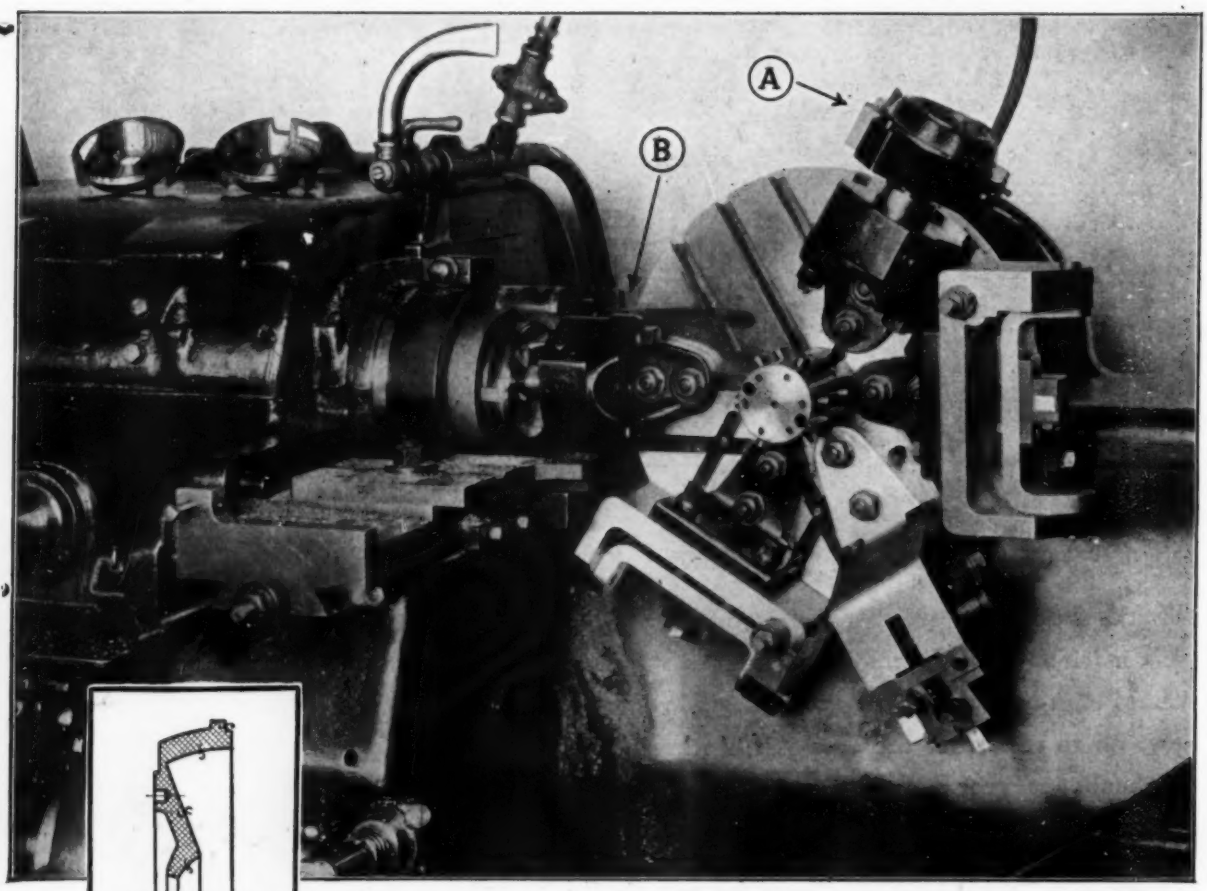
SALES AND ENGINEERING OFFICES

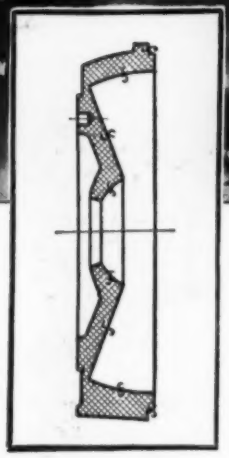
NEW YORK	BOSTON	PHILADELPHIA	SYRACUSE	CHICAGO
L. C. Biglow & Co., Inc. 250 W. 54th St.	The Whitney Mfg. Co. 711 Boylston St.	The Whitney Mfg. Co. 133 So. 36 St. Philadelphia Gear Works Erie Ave. and G St.	George McPherson 201 Norwood Ave.	The Whitney Mfg. Co. 549 W. Washington Blvd.

PITTSBURGH	CLEVELAND	DETROIT	SAN FRANCISCO	SEATTLE
Pittsburgh Gear & Mach. Co. 27th & Smallman Sts.	Smith Power Transmission Co. 1213 W. Third St.	The Whitney Mfg. Co. 2-240 General Motors Bldg	A. H. Coates Co. 615 Howard St.	A. H. Coates Co. 1743 First Ave. So.

CHAINS AND SPROCKETS FOR POWER TRANSMISSION

Get economical production plus with these modern





Turning the one angular and two radial internal surfaces of these bronze water meter parts to the very close limits and fine finish required is an interesting example of the possibilities of Brown & Sharpe Automatics.

The two radii are turned by simple yet carefully designed single point radius turning tools and the angular surface with an angular slide tool. All three tools are operated by the cross slide.

An automatic spindle loading and unloading arrangement enabled one operator to run both of the two machines which were furnished with this set-up. The piece is placed on the loading tool (A) which in turn sets it in the holding chuck on the spindle. When finished the piece is picked off by the tool (B), from which it is removed by the operator. The spindle is automatically stopped during the loading and unloading operation.

The complete set-up was designed and made by our Screw Machine Engineering Service Department. It will profit you to take advantage of the long experience of our engineers by bringing your production problems to them.

accuracy automatics for larger parts

Brown & Sharpe Products

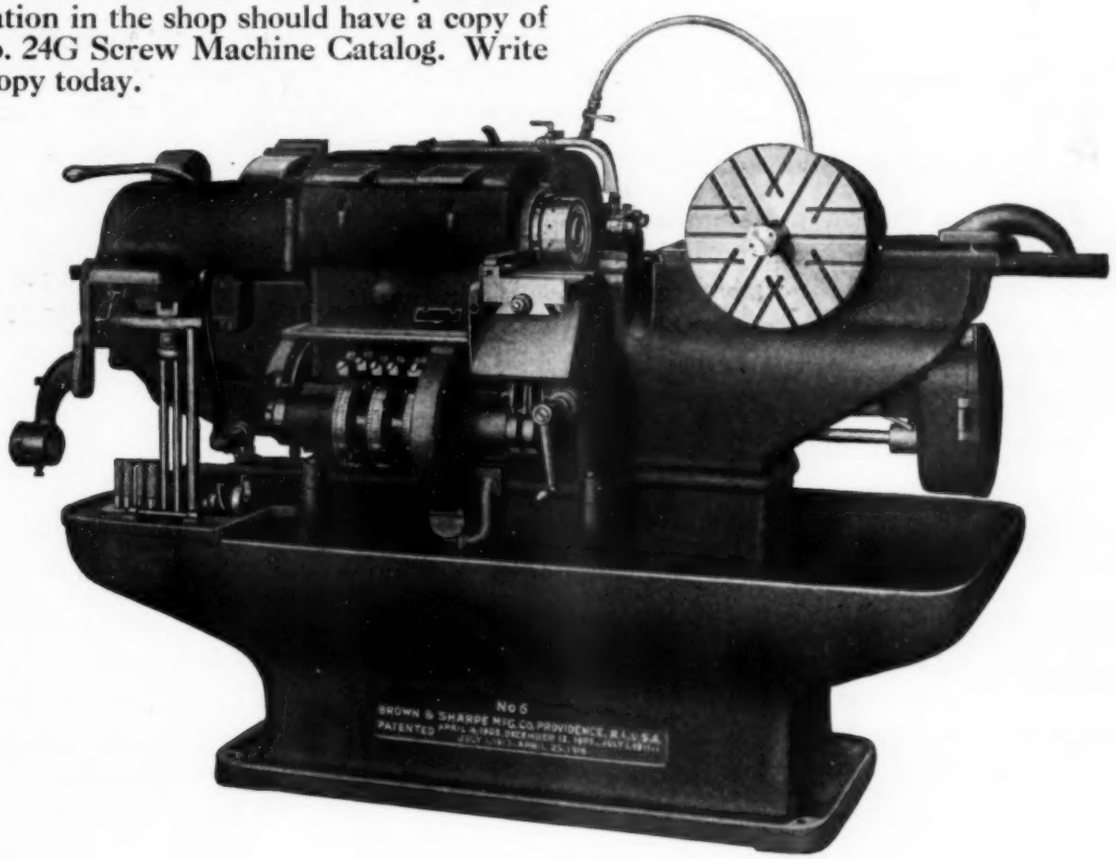
Milling Machines
Grinding Machines
Gear Cutting Machines
Screw Machines
Cutters and Hobs
Machinist's Tools
Gears Cut to Order

Brown & Sharpe Automatic Screw Machines

The profit making, record production of Brown & Sharpe Automatic Screw Machines is a by-word from Cleveland to Calcutta.

The "big brothers" of the family, Nos. 4 and 6, share this fame in their field, the rapid and accurate production of larger turned parts. An interesting application of the No. 4 is shown on the opposite page.

Everyone interested in the latest developments in screw machines and their profitable application in the shop should have a copy of the No. 24G Screw Machine Catalog. Write for a copy today.



BROWN & SHARPE

BROWN & SHARPE MFG. CO. PROVIDENCE, R. I., U. S. A.

For 1928—The Super

"Everything comes to him who waits—providing he picks out the right waiting point. And, Kennedy, with but two days left in 1927, it's time we verified the correctness of our position in the receiving line for 1928. There—how's that for a speech?"

"That sounds educated, Hawkins. Have you done any work on the verification?"

"Most certainly have, Kennedy. Here's the basis for my line of reasoning. Want to hear it."

"Go ahead. I'll check you as you go."

"First off, our line of manufacture has been changed considerably to our profit by our use of new materials. Die castings, I mean, for one, special nonmetallic compounds, new non-ferrous metals, new and better steels, ball and roller bearings."

"Don't forget centralized lubrication."

"That's right—centralized lubrication, and there are a number of complete parts we now buy that were costing us too much to make."

"Second, we've stepped production up and costs down with the new machines we've been able to buy, thanks to our sinking fund for the purpose."

"Third, our hand work is looking up very considerably since we began purchasing good hand tools for our men."

"And rejected work is on the decrease, Hawkins."

"Yes, that's because we tooled up the inspectors properly and tied them in with the production gages.

"Fourth, our floors are not littered up so badly. We move with more freedom. Why? Because we've begun to realize the value of adequate material handling equipment."

"We still have a long way to go on the material handling, Hawkins."

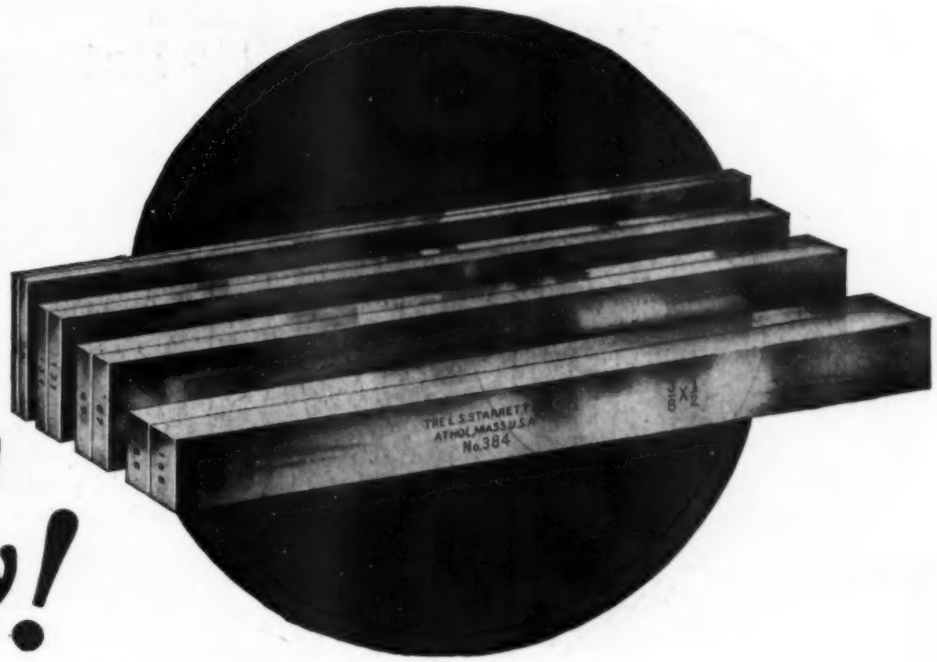
"That's right, Kennedy, but we are on our way. Fact, we have a long way to go on many things, but we're moving along. I could name many more facts in five, six, seven order, but what's the need?

"Where did we get most of our ideas? Where did we find out about all these tools and pieces of machinery and equipment and the materials and parts and supplies?"

"That's simple to answer, Hawkins. We found them right in these ad pages."

"Right, Kennedy! Here's where we've stood and received the benefits that 1927 had to offer! Here's our waiting point for 1928!"

You'll find 'em mighty handy!



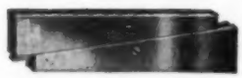
Starrett Tool Steel Parallels–hardened and ground

On machine platens and face plate set-ups, for milling, grinding and shaper vises — for checking and layout work you'll find them mighty handy.

Ground and finished in pairs of six inch length — they may be had in individual pairs or in standard sets of four pairs each, giving you a wide variety of working combinations.

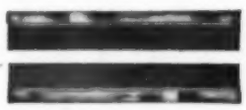
Starrett No. 384 Tool Steel Parallels may be had from your dealer. We will gladly send you a copy of our Catalog 23"C" showing standard sizes and prices. Prices on any special sizes quoted on request.

THE L. S. STARRETT CO.
World's Greatest Toolmakers
Manufacturers of Hacksaws Unexcelled
Steel Tapes–Standard for Accuracy
ATHOL, MASS., U. S. A.



Starrett Adjustable Parallels No. 154

These parallels may be adjusted and locked to micrometer measurements. Very convenient for milling, planer and shaper vise work.



Starrett Hold Downs No. 54

For machine vise work or for securing work to a machine platen where a light amount of material is to be removed from the surface, Starrett Hold Downs grip the work firmly without distortion. Made of tool steel, hardened and ground.

Use Starrett Tools

1832

"CJB" Stands for Quality

THE mark of ball bearing perfection stamped on every "CJB" Bearing of our manufacture stands for years of working familiarity with bearings of every design and make. It is a symbol chosen by master craftsmen to mark the finest product of their experience and skill.

The proof of quality is economy of service.

AHLBERG BEARING COMPANY
321 E. 29th Street, Chicago, Ill.

Ahlberg

CJB

"MASTER"
BALL BEARINGS

Better Bearings

SOLID or split; plain, ring or collar-oiled; also built in the new anti-friction style.
The bases are ground smooth and both ends finished. Built in all standard sizes, you are certain to obtain prompt shipment from Caldwell stocks.

CALDWELL PRODUCTS
Car Spotters, Bearings, Shafting, Pulleys, Gears, Chains, Wheels, Helicoid Conveyor and Accessories, Belt Conveyors, Chain Conveyors, Elevator Buckets, Boots and Casings.

H. W. CALDWELL & SON CO.
(LINK-BELT COMPANY, OWNER) C-98
CHICAGO: Western Ave., 17th and 18th Sts.
Dallas, Texas: 1221 Mercantile Bank Bldg.
New York: Woolworth Bldg.

CALDWELL

THE MOST COMPLETE LINE OF BALL BEARINGS TYPES AND SIZES IN AMERICA

FAFNIR

TRANSMISSION EQUIPMENT
THE FAFNIR BEARING CO. NEW BRITAIN, CONN.

New York
Chicago
Philadelphia
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San Francisco

BUNTING
PHOSPHOR BRONZE
BUSHING BEARINGS

360 Sizes—Always in Stock.

THE BUNTING BRASS & BRONZE CO.
TOLEDO

BCA THRUST BALL BEARINGS
For Machines of All Types
BEARINGS CO OF AMERICA
LANCASTER PA U.S.A.
DETROIT HIGH OFFICE 1010 FORD BLDG.

ABBOTT BURNISHING

ABBOTT BALL COMPANY
"Originators of Commercial Ball Burnishing"
1042 New Britain Ave., Hartford, Conn.

equipment, complete from balls, cones, pins and slugs to the latest type barrels. Send sample parts for a burnishing estimate, no obligation.

They make S-P-E-E-D possible

STRIP equipment of its ball bearings and what is the result? Still a splendid machine . . . but as incapable of operation as a locomotive sans steam.

The tremendous responsibility thus imposed upon ball bearings makes it peculiarly important to select them with care. Both the bearings and your reputation with users are at stake.

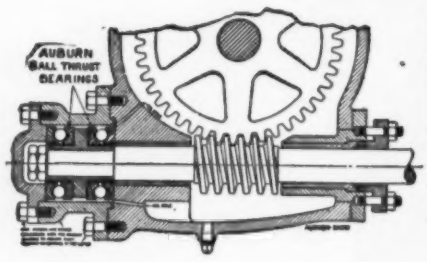
That is why Torrington Ball Bearings are recommended for your serious consideration. They meet laboratory and shop tests. As to the ultimate test... usage in the hands of machinery owners . . . Torringtons are provenly successful because provenly UNIFORM.

The Torrington Company
ESTABLISHED 1866
Torrington, Conn., U.S.A.

DISTRICT SALES REPRESENTATIVE:

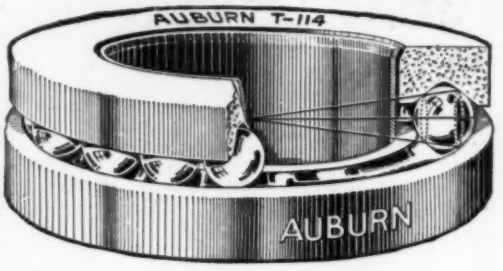
S. W. ANDERSON
565 W. Washington Blvd.
Chicago, Ill.

Production Problems answered with Auburn Thrusts

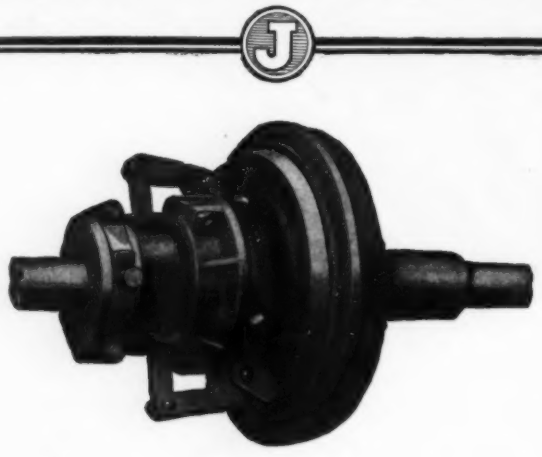


Machine Shut Downs are serious delays where production must be kept at a steady rate. Auburn Ball Thrust Bearings by their special features withstand heavy service and have a long life. For Special Fixtures and Tools, Auburn Bearings are just what is needed whenever there is End Thrust to be cared for. Ask for data sheets and send details of your problem.

Steel, Brass and Bronze Balls



AUBURN BALL BEARING CO. Established 1893 25 Elizabeth St., ROCHESTER, N. Y.



The "Lemley" Friction Clutch

Send for Catalog No. 30

W. A. Jones Foundry & Machine Company
4404 West Roosevelt Road, Chicago, Ill.

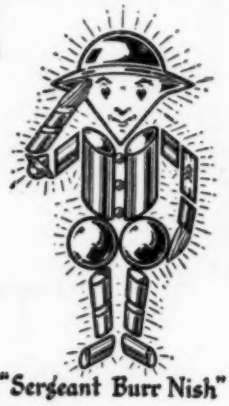
Branch Sales and Engineering Offices:
New York Pittsburgh Milwaukee Cleveland Buffalo Detroit
Birmingham St. Louis Cincinnati Los Angeles
San Francisco Peoria

Jones

Power Transmitting Machinery

High Carbon Chrome and Tool Steel Balls for Bearings
Brass and Bronze Balls
Steel Burnishing Balls and Metallic Burnishing Materials

THE HARTFORD STEEL BALL CO.
609 Franklin Ave., Hartford, Conn.



"Sergeant Burr Nish"

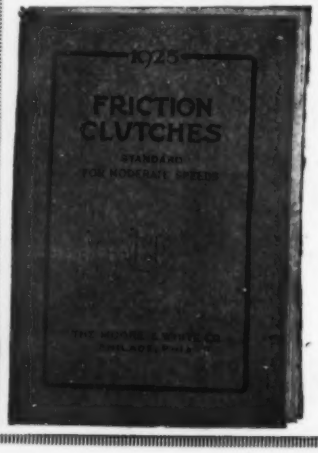
For all types of industrial machinery

The applications of Raybestos run the gamut of Industrial machinery. It serves as a frictional slip clutch on fractional horsepower motors and effectively brakes 50-ton cranes. The essence of more than 20 years' experience is at the call of any manufacturer. Ask us to recommend the right size and type. Catalog upon request.

Silver Edge **Raybestos**

THE RAYBESTOS COMPANY
Bridgeport, Conn.

The Canadian Raybestos Co., Ltd.
Peterborough, Ont., Canada
Raybestos-Belaco, Ltd., London, Eng.



Moore & White

Friction Clutches

Catalog "E" Free

THE MOORE & WHITE CO.
2701 to 2731 N. 15th Street
Philadelphia, U. S. A.

FEWER STOPS GREATER OUTPUT
RHOADS
Tannate Leather Belting

J. E. RHOADS & SONS
Philadelphia, 33 N. 6th St. Cleveland, 1202 W. 9th St.
New York, 100 Beekman St. Atlanta, 71 Forsyth St. S.W.
Chicago, 320 W. Randolph St. Factory Wilmington, Del.

BROWN'S
MULE-PULL CLUTCHES

Have working parts wholly enclosed.
Brown Engineering Co. 115 N. Third St., Reading, Pa.

MAC-IT SCREWS

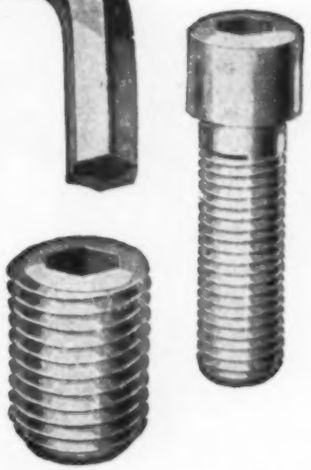
Hollow Set
Socket Head Cap

—For safety and hard service. For tight set up and frequent adjustment.

Positively will not "round" in the hexagon hole, nor will they split, spread, or upset at the point. Clean cut threads insure a close fit.

Mac-its are furnished in all types and sizes of set screws and cap screws. Guaranteed to give satisfaction.

Ask your dealer for Mac-its, or write

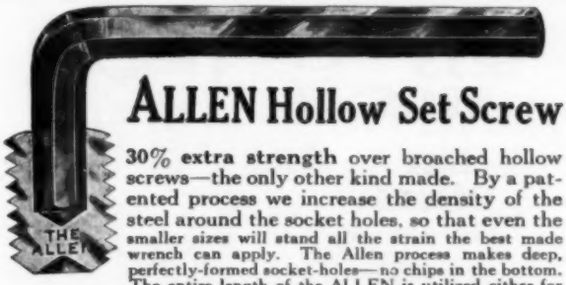


Mac-it hollow set screws are stocked in cup point U.S.S. thread and S.A.E. threads, Dog point in U.S.S. thread. Mac-it socket head cap screws in U.S.S. thread only. One wrench is supplied with every 25 screws.

THE STRONG, CARLISLE & HAMMOND CO.

General Distributors

1392-1394 West 3rd St., CLEVELAND, OHIO



ALLEN Hollow Set Screw

30% extra strength over broached hollow screws—the only other kind made. By a patented process we increase the density of the steel around the socket holes, so that even the smaller sizes will stand all the strain the best made wrench can apply. The Allen process makes deep, perfectly-formed socket-holes—no chips in the bottom. The entire length of the ALLEN is utilized either for solid metal at the point, or depth of socket for the wrench. All sizes in stock from ¼ to 1½ in.; any length, point or thread. Also Pipe Plugs, Socket-Head Cap Screws and Tap Extensions—ALLEN process. Descriptive catalogue on request.

THE ALLEN MFG. CO. 129 SHELDON ST. HARTFORD, CONN

Send for Samples

Try a few Genuine "Keystone" Positive Type Lock Washers on any kind of holding job you can find. See for yourself how the claw-like ends dig in and hold despite vibration.

Ask for your samples, and catalog today.

Trade Mark Registered

The Positive Lock Washer Co.
Newark New Jersey
Pacific Coast Agents: Maydwell & Hartzell, Inc., 158 11th St., San Francisco, Cal.
Foreign Agents: Positive Lock Washer Co., 21 York St., Glasgow, Scotland.
For Nearly Forty Years—Lock Washers Exclusively

BRISTO SAFETY SET SCREWS

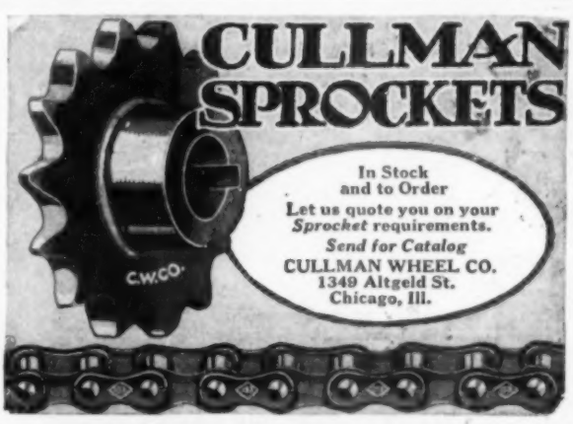
Positive action socket design is most effective. Tighter set. Also used in Bristol *Socket Head* Cap Screws. Send for new Bulletin B-820 and test samples.

THE BRISTOL COMPANY, Waterbury, Conn.

ECONOMY CENTER POINTS

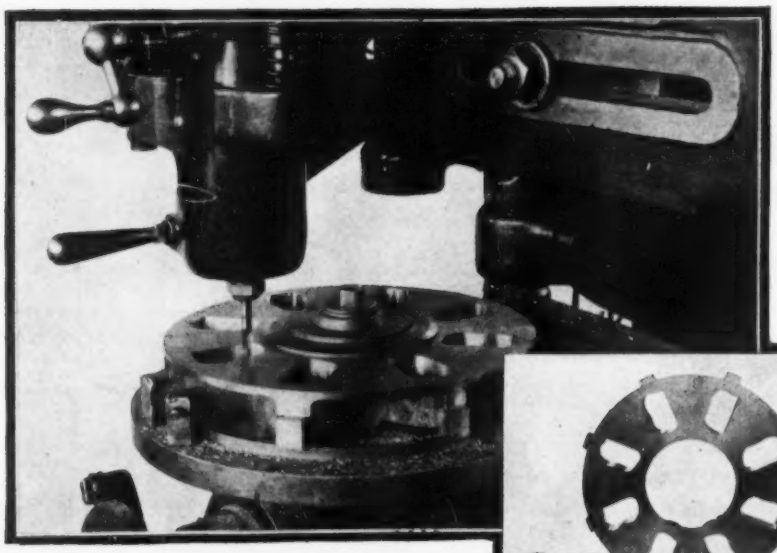
The removable points may be changed without the aid of special tools and without disturbing the point holder.

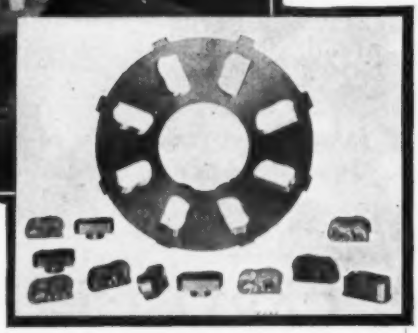
Atwood Manufacturing Equipment Co., Anderson, Ind., U. S. A.



Precision Machines

for heavy work





Inset shows a brass candy form with inserts. The diameter of the form is about 14-in. with eight irregular shaped cavities 1½-in. deep cut out on a 1-S machine. The inserts are also shaped to suit cavities. Time required for this, including the making of the template was twelve hours.

Large machines have been developed in the past five years that are accurate and durable and as perfectly made as thirty years of experience can make them. These are precision machines and have been fully tried out in many shops. Gortons supply the demand for very heavy machines that can sink heavy dies, cut steel stamps, letters, and gun work in steel, brass, and cast iron.

The No. 1-S Universal Die Sinking and Engraving Machine has a pantograph range of reduction from 1 to 1 down to 6 to 1. Complete specifications will be sent upon request. Just write the George Gorton Machine Co., Racine, Wisconsin.

UNIVERSAL DIE SINKING and ENGRAVING MACHINE

TRADE MARK
GORTON
RACINE, WIS., U. S. A.

Holds Any Shape Bar Stock

Rounds, squares, hexagons and irregular stock can be held securely in the Ney "Positive Grip" Work Holder without danger of marring the work or twisting the stock.

Ask for details of our 30 day free trial offer.

Catalog?

The J. M. Ney Co.
Hartford, Conn.

GITS BROS.

Better Oilers

287 Styles & Sizes

GITS BROS MFG. CO.
1940 S. Kilbourn Chicago

"A"

"B"

A size and style for every purpose

Simplicity, low cost and fitness for the particular oiling condition characterize these popular Bennett Oil Cups.

Made in sheet steel and brass. Write for Catalog and samples.

"C"

"D"

Bay State Stamping Co.
380 Chandler St., Worcester, Mass.

BENNETT
HANDY-TOP OIL CUPS

TUCKER OIL HOLE COVERS

Made in a variety of styles and many sizes to suit all needs. Send for descriptive catalog 10 and price list.

W. W. & C. F. Tucker, Inc.
Hartford, Conn.

Rivett Collets

All sizes—all styles in stock

RIVETT LATHE & GRINDER CORP.

Brighton District of Boston, Mass.

The old masters of the art of toolmaking

Acme Drill Bushings

Leader Pin Bushings — Hardened and Ground
Leader Pins — Dowel Pins
Expansion Laps

Send for Data Sheets and Price List.

Acme Industrial Co., 417 N. Carpenter St., Chicago
173 Lafayette St., New York

DRILL JIG BUSHINGS

XLO

Specializing in this product, Ex-Cell-O offers lowest prices, prompt shipments. Send for cost-cutting data sheets.

Makers of XLO Grinding Spindles
EX-CELL-O TOOL & MFG. CO.
1467 E. Grand Boulevard, Detroit

"MILWAUKEE" Engineering Service
—has made good its every promise of better results from the use of Die Castings. May we exchange specifications?
MILWAUKEE DIE CASTING COMPANY
291 4th Street — Milwaukee, Wisconsin

MILWAUKEE BEARINGS AND DIE CASTINGS

FRANKLIN DIE-CASTINGS

We cast in Aluminum, Tin, Lead and Zinc base alloys. Estimates made from samples, drawings, or blue prints. Send for booklet.

FRANKLIN DIE-CASTING CORPORATION
Gifford and Magnolia Streets, Syracuse, N. Y

Stewart Die Castings

Send Blueprints for Estimates

STEWART DIE CASTING CORPORATION
4500 Fullerton Ave., Chicago

PULLEYS

Cast Iron of all sizes
and every description

THE A. & F. BROWN CO.
ELIZABETHPORT, N. J.

BURKE ELECTRIC CO.

MOTORS, GENERATORS ERIE, PA. ARC WELDERS

Sales Offices: Buffalo Chicago Cleveland Detroit New York Philadelphia Pittsburgh
Sales Agencies: Akron: Berthold Electric & Engineering Co. Boston: C. A. Cotton. Cincinnati: Underwood Electric Co. Indianapolis: W. C. Fletcher Co. Kansas City: W. T. Osborn. Milwaukee: Fred H. Dorner. St. Louis: Louis D. Moore. Troy, N. Y.: E. I. Van Doren. Tulsa: The Cost Cutting Co.

We specialize in motors, ½ to 150 hp. constant and adjustable speed D.C.; squirrel cage and slip ring A.C.

RELIANCE MOTORS

Reliance Electric & Engineering Co., 1044 Ivanhoe Rd., Cleveland, O.

IN THE SERVICE OF POWER CONSERVATION

POWER generated in the boiler and engine rooms usually is transmitted by means of belts, shafting and pulleys to the machinery it operates.

Every transfer of power from one point to another involves some loss.

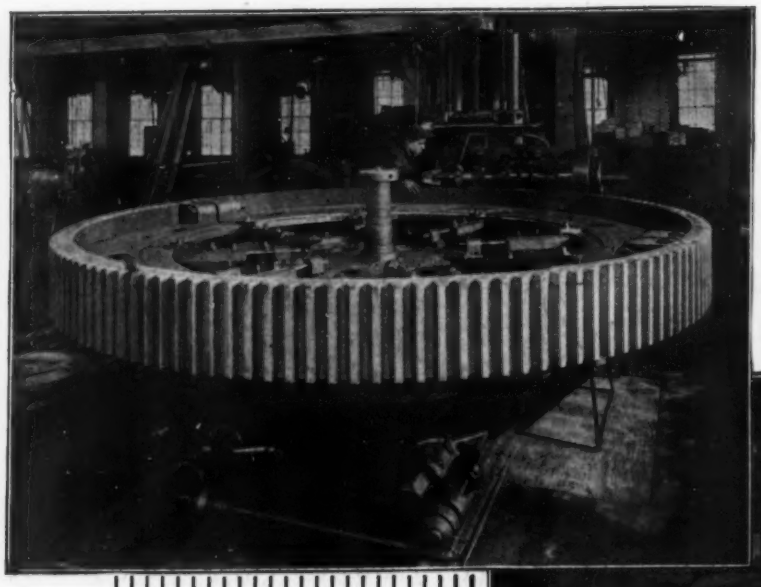
But the advanced design and construction of "American" Steel Split Pulleys and "American" Pressed Steel Hangers cut down this toll of friction, inertia and other forms of resistance.

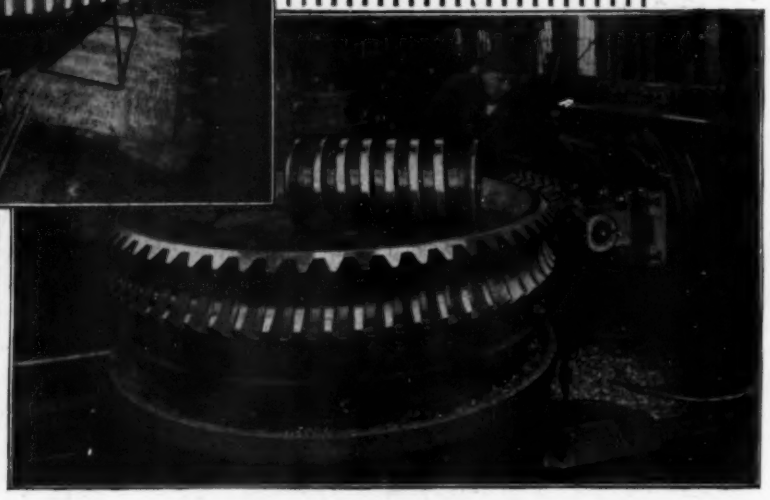
Light in weight but strong in duty. Arms that cut the air and do not fan. A rim surface that grips the belt.

This and more is explained in several special folders. Write for them, or call up the nearest "American" dealer. He can explain. You will find his name and address in MacRae's Blue Book.

THE AMERICAN PULLEY CO.
Manufacturers of Steel Split Transmission Pulleys, Pressed Steel Shapes, Pressed Steel Hand Trucks and Pressed Steel Shaft Hangers
4200 Wissahickon Avenue — Philadelphia, Pa.

AMERICAN
PRESSED STEEL HANGERS — STEEL SPLIT PULLEYS
PATENTED — PATENTED





More truth than poetry!

"A Breakdown may come but once a year, But when it does, though far or near, Get in touch with Phillie Gear"

Poetical (?), but sensible. A broken Gear not only means the idleness of one or more men, but sometimes the whole tie-up of a department,—loss of money, lateness in delivering a promised order, and what not.

At such a time, you just can't afford to "shop around" for a new Gear; you must BE SURE that you will get the new gear in the QUICKEST POSSIBLE TIME.

For nearly 50 years we've been making Gears for "Hurry-Orders and Breakdown jobs." Our men are trained to think quickly and act quickly, and our shops contain the most modern equipment for both accurate and speedy production.

Your judgment of us will be based upon performance,—not claims or promises,—why not test us out on that next "rush order"?

PHILLIE GEAR

Power Saving Products

Our products include:

Spur, Bevel, Spiral
Internal and Herringbone Gears
Fabroil, Textolite, Rawhide and Celeron Pinions
(Shipped in 24 Hours)
Worms, Worm Gears, Racks
Whitney Silent & Roller Chains
Sprockets, Ratchets
Speed Reducing Units
(All Sizes, Types, Ratios, Drives)

Main Office and Plant Erie Ave. and G St. Phila., Pa.

PHILADELPHIA GEAR WORKS

Manufacturers of Industrial Gears and Speed Reducing Units

PHILADELPHIA, PENNA.

Branch Sales and Engineering Office: 12 E. 41st St., New York

GEARS — WORMS — WORMWHEELS — CAMS
OF EVERY DESCRIPTION CUT TO ORDER

THE HARTFORD SPECIAL MACHINERY CO.
TOOLS AND FIXTURES
HARTFORD, CONN.
ESTIMATES PROMPTLY FURNISHED
SPECIAL MACHINERY DESIGNED AND BUILT

MP Gears

Meisel Gears are well known for their superiorities under every sort of operating condition. This reputation is the result of many years of specialized production of gears of the better type. Gears that are well made—mesh correctly and run smoothly for exceptionally long periods.

We also do broaching, tooth Rounding, splining and screw machine work.

Estimates gladly made.

Meisel Press Mfg. Co.
946 Dorchester Ave.
Boston, Mass.

HERRINGBONE CUT GEARS
MILL DRIVES
FAWCUS
SPUR WORM BEVEL GEARS
SPEED REDUCERS
FAWCUS MACHINE CO. PITTSBURGH. PA.

EARLE GEARS
THE EARLE GEAR & MACHINE CO.
4707-15 Stenton Ave.
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Cut Spur, Bevel and Worm Gears
All sizes. Every description. Operating Machinery for Bridges, etc.
"Lea Simplex" Cold Metal Saws.

Before you place the next order for gears ask us for an estimate

Gears of every description

Spur
Bevel
Spiral
Racks
Worm
Internal
Rawhide
Fabroil
Phenolic
Sprockets
Baldwin Chains

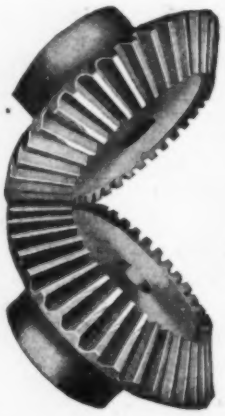
We are in a position to serve you with good gears of every description.

An opportunity to quote prices on gears in any style or type is all we ask.

You will welcome the prices submitted and the promptness of our service.

The Cincinnati Gear Co.
1825-41 Reading Road, Cincinnati, Ohio

GRANT GEARS



Reliable

For fifty years Grant Gears have proved themselves to be "reliable" on all sorts of difficult drives. Trueness to specifications and quality of materials are the basis of this dependability.
Our engineering department will gladly aid you in solving any of your gear problems.
We will be pleased to make estimates on your blueprints or samples. *Catalog on request.*

Makers of Good Gears Since 1877

GRANT GEAR WORKS

B AND SECOND STREETS, BOSTON, MASS.

SIMONDS GEARS
and
Speed Reduction Units

Our standard or made to special design.

Quotations mailed promptly on receipt of drawings.

THE SIMONDS MANUFACTURING CO.
PITTSBURGH, PA.

CUT GEARS-SPLINED SHAFTS

The
MACHINE PRODUCTS COMPANY
Cleveland, Ohio

Ready to accept orders
for immediate attention

DIEFENDORF GEAR
CORPORATION
SYRACUSE, N. Y.

40 Years of Gear Mfg Experience
FOOTE BROS.
GEAR & MACHINE CO.
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ALL TYPES and KINDS of GEARS

Nuttall Gears
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Gears and Speed Reducers
of Every Description
THE A. & F. BROWN CO.
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GEARS
Cut to Your Specifications
Spur — Helical — Worm — Screws — Racks
THE ADAMS COMPANY *(Est. 1883)*
1900 Bridge St., Dubuque, Iowa

ATLANTIC GEARS
Spur, Spiral, Worm, Internal
Bevel and Sprocket
Accurately cut bevel and spiral gears for any purpose. Quick service for break-down jobs and Bakelite motor pinions.
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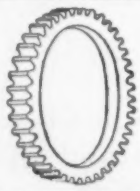
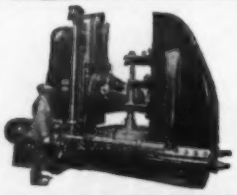
PFAUTER
Over 1500 Machines in the U. S. A.
Gear Hobbers
Hob Sharpeners—Thread Millers
Write for descriptive Bulletins
Representatives for United States and Canada
O. ZERNICKOW CO., 13 Park Row, New York, N. Y.



"PENMAID"
GEARS
REDUCTION UNITS
Spur, Bevel, Worm, Spiral, Mitre
Pennsylvania Gear & Machine Co., Inc.
2239-49 E. Tioga St., Philadelphia, Pa.



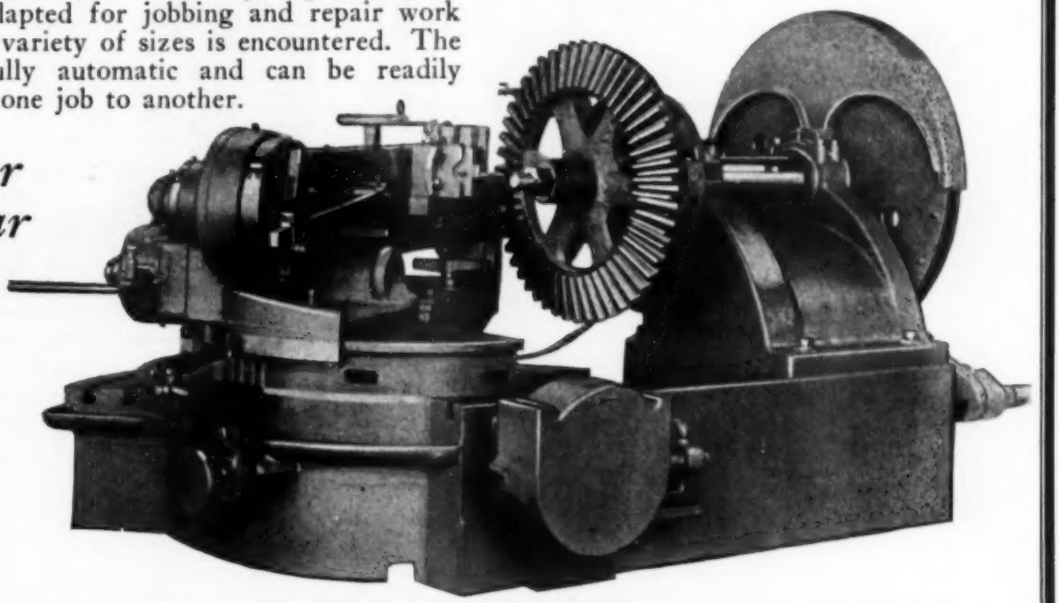
Schuchardt & Schutte
Modern Gear Hobbers
¼ in. to 263 in.
Greater rigidity and power eliminating torsion and chatter. Investigate.
SCHUCHARDT & SCHUTTE OF NEW YORK
Geo. Scherr Co.
142-4 Liberty St., New York

54" Straight Bevel Gear Planer

This sturdy machine, with its easy, rapid setup, is particularly adapted for jobbing and repair work where a large variety of sizes is encountered. The machine is fully automatic and can be readily changed from one job to another.

Write for a Circular

The machine cuts straight tooth bevel gears with 3.375-in. Circular Pitch or finer, and a cone distance of 38¼-in. or less. Tool speeds range from 10 to 70 strokes per minute.



GLEASON

GLEASON WORKS ROCHESTER, N. Y., U. S. A.

Manufacturers of Gears and Bevel Gear Machinery for over sixty years

GEAR GENERATORS

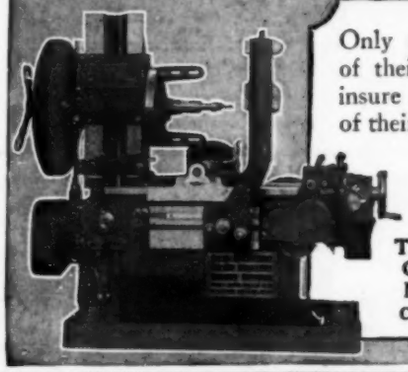
Straight Tooth or Spiraloid Bevel Gears

Up to 32-in. O.D. cut Theoretically correct. SPECIAL facilities for CUTTING, in any MATERIAL. SPUR, MITRE, WORM, HELICAL, INTERNAL, ELLIPTICAL GEAR WHEELS, SKEW (Hypoid) BEVEL GEARS.

Let the *originators* of *Spiraloid* and *Skew (Hypoid)* GEARS with offset AXES solve your GEAR PROBLEMS

THE BILGRAM MACHINE WORKS
1233 Spring Garden St., PHILADELPHIA, PA.
Manufacturers of GEARS and GEAR CUTTING MACHINES

CINCINNATI GEAR CUTTERS



Only a knowledge of their details can insure appreciation of their value.

Write for Catalog.

The Cincinnati Gear Cutting Machine Co.
Cincinnati, Ohio

"STANDARDIZATION PAYS"

They Speed To You!

"Timken Equipped" for long life

Standardized Speed Reducers for **immediate delivery.** Booklet "Industrial Speed Reduction" gives specifications and prices.

BOSTON GEAR WORKS SALES CO.

BOSTON GEARS

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Boston New York Philadelphia Cleveland Chicago

S. S. White Flexible Shaft Tools

For Grinding, Burring, Drilling, Assembling, etc.

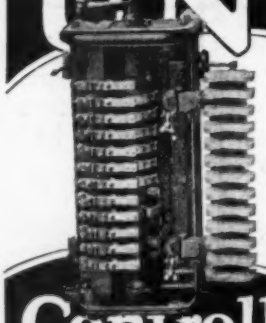
Or for that matter on any work where portability and handiness are desirable features.

Put S. S. White Flexible Shaft Tools where they are accessible to your high priced skilled mechanics and see for yourself how they will turn out more and better work at considerably lower output costs.

Our illustrated catalog shows dozens of uses in all classes of work. *May we send it?*

The S. S. White Dental Mfg. Co.
Industrial Division
152 W. 42nd St., New York, N. Y.

UNION Conrollers



Specially Designed for

Hoisting Machinery. Metal and Woodworking equipment. Electric Trucks and Tractors. Mine Locomotives. Pumps, Fans and Blowers. All General-Purpose Motor Control applications.

Send for bulletins and detailed information.

Union Electric Mfg. Co.
Milwaukee, Wisc.
20 Sales and Service Offices

Strand Rotary Files

Used with Strand Flexible Shaft Machines. Are giving excellent service.

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5001 No. Lincoln St.
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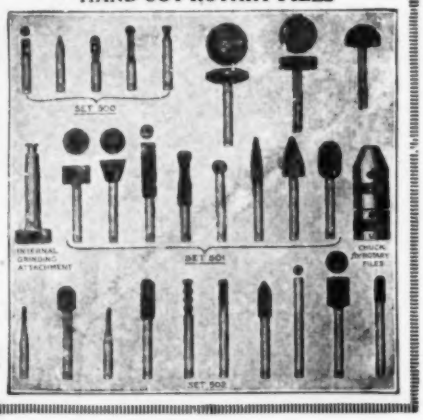
HIGH SPEED
HAND CUT ROTARY FILES



OHIO Torque Motors

Ohio Torque Motors are of special patented design for operation where a *slow speed* or *locked condition* with a *high torque* is required without excessive heating.

These characteristics are especially desirable for operating elevator controls, door opening devices, brakes, etc.

Ohio Fractional Horsepower Torque Motors are available for 100%, 50%, 25%, or 10% Locked Service.

Write for complete details.

Ohio Electric & Controller Co.
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Also manufacturers of a complete line of Standard A.C. and D.C. Motors

Write for Special Bulletins on
Haskins Flexible Shaft Equipments.

For lower Grinding, Die Sinking, Pattern Making, Filing, Scraping, Buffing and Polishing Costs.

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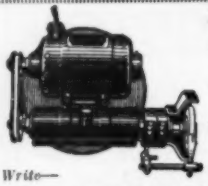
Hisey Electric Drills Grinders Buffers

Catalogue on request
THE HISEY-WOLF MACHINE CO.
Cincinnati, Ohio
Represented in all principal cities.



DUMORE

High Speed Electric Grinders

Are dynamically balanced and vibrationless
Light and portable, easily carried to any job or setup.
Operate equally well on AC or DC.
Designed for internal or external precision grinding.
Six styles and sizes provide a grinder for every need.

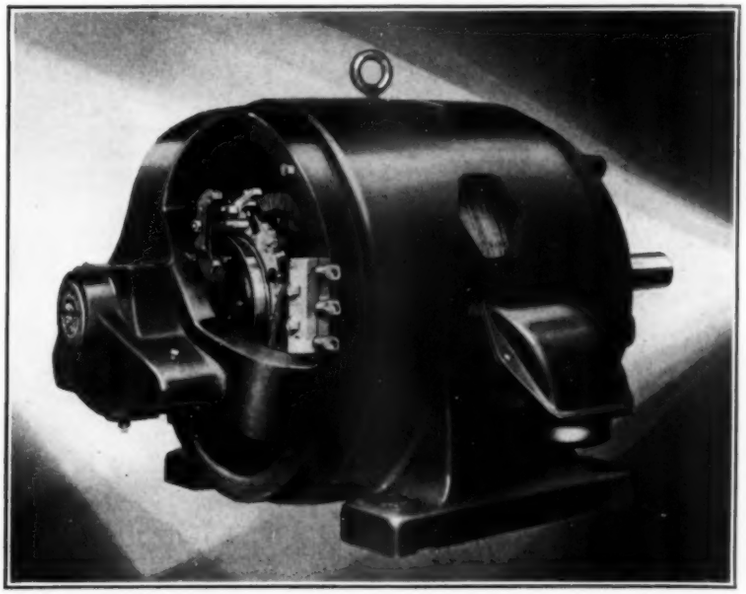
Write—
WISCONSIN ELECTRIC CO., 27 Sixteenth St., Racine, Wis.

Newark Gear Cutting Machine Co.

Henry E. Eberhardt, Pres.
Gear Specialists
We make gears to order
69 Prospect Street, Newark, N. J.
Phone: Market 7725
Manufacturers of Gears, Automatic Gear Cutters and Cutter Grinding Machinery

APPLICATIONS

This is one of a series of advertisements describing the proper application of alternating-current motor types. Complete series will gladly be sent on request.



Variable speed . . . . .

as related to current draw

The slip-ring motor is the only type of polyphase motor adapted to variable speed service. The starting torque and the starting current are under the control of the operator and may be varied at his will.

Accordingly, the slip-ring motor permits the heaviest loads to be started slowly and smoothly with no objectionable line disturbances.

Any starting torque up to 250 per cent of full load torque may be obtained when provided with proper starting resistance. Smooth acceleration between speed points is almost inherent in this type of motor with modern controllers provided with an ample number of steps.

Wagner Slip-ring Motors are sturdy motors. They have heavy bronze slip-rings... bronze brush holders, each supported upon two independent studs. Wagner Slip-ring Motors are designed for moderate rotor voltages, thus reducing the probability of insulation trouble.

WAGNER, QUALITY ALTERNATING-CURRENT MOTORS

Wagner builds them all

SLIP-RING MOTOR APPLICATIONS

Fans—Blowers—Dredges—that require a variable speed control

Rock Crushers, Compressors, Pumps of large capacity, Ball Mills, Power Jacks, Cotton Gins, because high starting torque is required

Wagner Quality

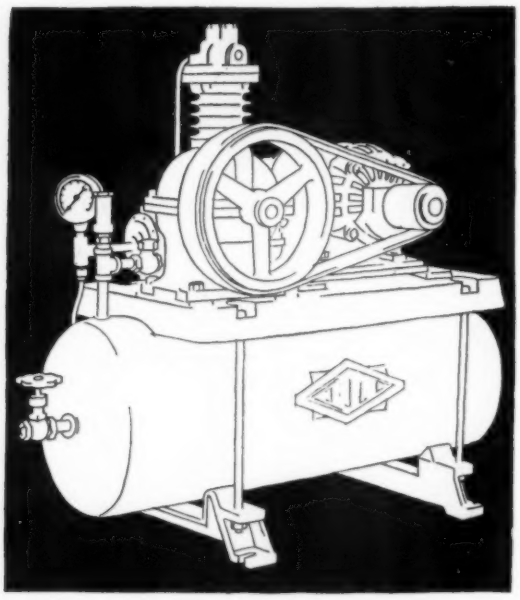
WAGNER ELECTRIC CORPORATION—6400 Plymouth Avenue—St. Louis, U. S. A.

Products: MOTORS—Single-phase, Polyphase and Fynn-Weichsel Motors TRANSFORMERS—Power, Distribution and Instrument FANS—Desk, Wall and Ceiling types

61-6338-5

WAGNER SMALL MOTORS

Back of the Wagner small motor is the entire building experience of one of the oldest electrical manufacturers in the country and today the largest west of the Mississippi.



Motors *for Air Compressors*

Wagner Motors operate on low voltage

An air compressor is only as good as the motor that drives it, and the opportunity for trouble is greater with a motor than with a compressor. Manufacturers who use Wagner Motors have at their disposal Wagner National Motor Service.

Branch offices in all of the principal cities and Wagner dealers in smaller towns are ready at all times to service Wagner equipment.

Wagner Motors—dependable—have large overload capacity so that they always start and carry the load.

Wagner Motors can be furnished in either a. c. or d. c. ratings, and mounting dimensions permit the interchange of Wagner Motors of different ratings.

Wagner Motors are easily reversible and leads can be changed by anyone. Bearings will not allow leakage or overflow of oil—filtered oil system of lubrication assures an abundance of clean oil.

Literature upon request

TEN PROMINENT USERS

Curtis & Company Manufacturing Co.
Quincy Compressor Company
Lipman Refrigeration Company
U. S. Air Compressor Co.
Frigidaire Corporation
Trane Company
Milwaukee Air Power Pump Company
Clear Vision Pump Company
Champion Pneumatic Machine Co.
American Floor Machine Co.

Wagner Quality

WAGNER ELECTRIC CORPORATION—6400 Plymouth Avenue—St. Louis, U. S. A.

Products: MOTORS—Single-phase, Polyphase and Fynn-Weichsel Motors TRANSFORMERS—Power, Distribution and Instrument FANS—Desk, Wall and Ceiling types

61-6338-5

When the Metallurgist Says --

"It must be heat treated *like this"* --

YOUR metallurgists and heat treaters work out the heating processes for your products on individual pieces. They determine the best method of securing the results that you want. Then comes the necessity of reproducing these treatments in the production line. But it is no problem to work out if you place the responsibility for the job on Westinghouse electric furnaces. The production will be dependable day after day, for the electric control of temperature and the unchanging furnace conditions are inherent features of Westinghouse furnace operation.

Ask the nearest Westinghouse office to show you how to place your heat treating responsibility on Westinghouse furnaces. They will gladly work with you when your metallurgist says, "It must be heated like this".

Westinghouse Electric & Manufacturing Company
Industrial Heating Department
Mansfield Works Mansfield, Ohio

Sales Offices in All Principal Cities of the United States and Foreign Countries

Electric Furnaces

Westinghouse

X96434

JESSOP'S GENUINE SHEFFIELD STEELS

BEST CAST STEEL (YELLOW LABEL)
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SHEET TOOL STEEL

SUPERIOR OIL HARD'G, NON-SHRINK STEEL
SUPERIOR "ARK" HIGH SPEED STEEL
BEST QUALITY CIRCULAR PLATES
SPECIAL ALLOY TOOL STEELS

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FINE STEELS made by the CRUCIBLE PROCESS
CLARITE HIGH SPEED STEEL
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COLUMBIA SPECIAL CARBON TOOL STEEL
COLUMBIA EXTRA, ETC.

It pays to use Good Tool Steel.

COLUMBIA TOOL STEEL COMPANY
MAIN OFFICE AND WORKS, CHICAGO HEIGHTS, ILLINOIS

MILFORD— the all-hard TUNGSTEN STEEL blade for power sawing—quality built for more than forty-three years.

MIL FLEX— the FLEXIBLE Blade, with hard teeth and soft backs, ideal for all hand sawing.

Free test samples on request

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Of Vital Interest to Manufacturers

The ever-increasing demand for alloys of a fixed standard of uniformity and excellence is fully met by

Elephant Brand

PHOSPHOR BRONZE

The introduction of Phosphorous into its composition reduces any oxides dissolved therein and forms with the purified metals a most homogeneous and regular combination, the hardness, strength, toughness, rigidity and elasticity of which are completely under control.

A grade for every requirement
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Rustless Iron
is a reality and found in its most perfect form in

DELHI Tough RUSTLESS IRON

Due to its wonderful properties it has been applied to more than 160 different uses.

May we send you some interesting facts on this product?

LUDLUM STEELS
SPECIAL STEELS — SPECIAL PURPOSES

The CARPENTER STEEL CO.
READING, PA.
Manufacturers of the
Highest grade tool and alloy steels
HOT ROLLED · HAMMERED
COLD ROLLED · COLD DRAWN

MAGNOLIA ANTI-FRICTION METAL
For Sale by Dealers Everywhere

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"CLARK" Tools Win by Comparison

Switch "Handy to the Hand."
Full line of electrically driven drills and grinders.
Send for Catalog

Jas. Clark, Jr., Electric Co., Incorporated
Louisville, Ky.

HIGH SPEED, CARBON, ALLOY TOOL STEELS
OF QUALITY OUR SPECIALTY
Vanadium Alloys Steel Co.
Latrobe - - Penna

Exceptional Steel Was Needed—
So Arter Spindles Are Vanadium Steels

IN THE Automatic Cylindrical Grinders manufactured by the Arter Grinding Machine Company, Worcester, Mass., the grinding wheel, mounted on a collet, is an extremely heavy unit, especially when wide wheels are used.

To the weight of the wheel is added the torque imposed by grinding, which is frequently so heavy as to require a 25-hp. motor to drive the machine.

For such a job, Arter writes, "Exceptional steel was needed in the spindle. We have found that Vanadium Steel is least liable to develop the checks and hard lines common in hardened spindles operating under high temperature conditions encountered in grinding wheel spindle bearings."

Whatever the machine tool requirement in steel, no matter how highly stressed the part or how severe the service, there is a Vanadium Steel that will serve satisfactorily. Our Metallurgists will be glad to help in the selection of better steels for your purposes.

VANADIUM CORPORATION OF AMERICA

CHICAGO Straus Bldg. NEW YORK 120 Broadway DETROIT Book Bldg.

Plants at Bridgeville, Pa., and Niagara Falls, N. Y
Research and Development Laboratories, Bridgeville, Pa.

In the Automatic Cylindrical Grinders manufactured by the Arter Grinding Machine Company, Worcester, Mass., grinding wheel spindles are made of Vanadium Steel.

VANADIUM STEELS

for strength, toughness and durability

Cast House at one of our blast furnaces

Supervision at the Source

ALLOY Steels of Agathon quality do not "just happen." Every step of their production from ore to finished steels is under strict supervision. The ore and limestone must meet our rigid tests and specifications. The coke is produced in our own ovens. We make our own pig iron in our own blast furnaces—the newest and most modern in America. Strict adherence to formula and painstaking care in every step of production—all are reflected in the high quality and reputation with which Agathon Alloy Steels are regarded by American industries.

Have you a copy of our Agathon Alloy Steel handbook?

We have daily production in our two completely equipped plants at Massillon and Canton in all kinds of Agathon Alloy Steels, such as:

Nickel, Chrome-Nickel, U M A, Molybdenum, Chrome-Molybdenum, Nickel-Molybdenum, Vanadium, Chrome-Vanadium, Chromium, etc.

Deliveries in Blooms, Billets, Slabs, Hot Rolled, Heat Treated, and Cold Drawn Bars, Hot Rolled Strips, etc.

Central Alloy Steel Corporation, Massillon, Ohio

World's Largest and Most Highly Specialized Alloy Steel Producers

Makers of Toncan Copper Mo-lyb-den-um Iron

Cleveland				St. Louis
Syracuse	Detroit	Chicago	New York	Seattle
San Francisco	Philadelphia	Los Angeles	Tulsa	Cincinnati

ACATHON STEELS

AGATHON ALLOY STEELS

Bakelite Molded is used for making the barrel, cap and threaded end piece of this Sterilizer made by The Nemmers Mfg. Co., New York.

Weight reduced one-half—appearance improved *and* cost reduced by Bakelite Molded

A TYPICAL example of the advantages and economies so often secured through the use of Bakelite Molded is the Nemmers Sterilizer for dental drill holders. The holder was originally made of metal which was not only heavy but required frequent polishing.

Through the use of Bakelite Molded the weight was reduced fifty percent, the design improved, and all polishing is unnecessary as Bakelite Molded retains its color and lustre. All of these advantages were secured at a saving in cost of 12½ percent, through the elimination of about twelve machining operations.

Manufacturers of many articles and parts formerly machined from metal, are now forming them of Bakelite Molded at a saving in cost and an improvement in quality and appearance.

Bakelite Cooperation

Bakelite Engineers, located in important industrial centers throughout the country, are equipped to render prompt and helpful cooperation to present and prospective users of Bakelite Materials. The Bakelite Corporation places at their service the facilities of its extensive laboratories, and its unequalled experience in the practical application of phenol resin products to industrial needs. Write for Booklet No. 34 "Bakelite Molded."

BAKELITE CORPORATION

247 Park Avenue, New York, N. Y., Chicago Office: 635 West 22nd Street

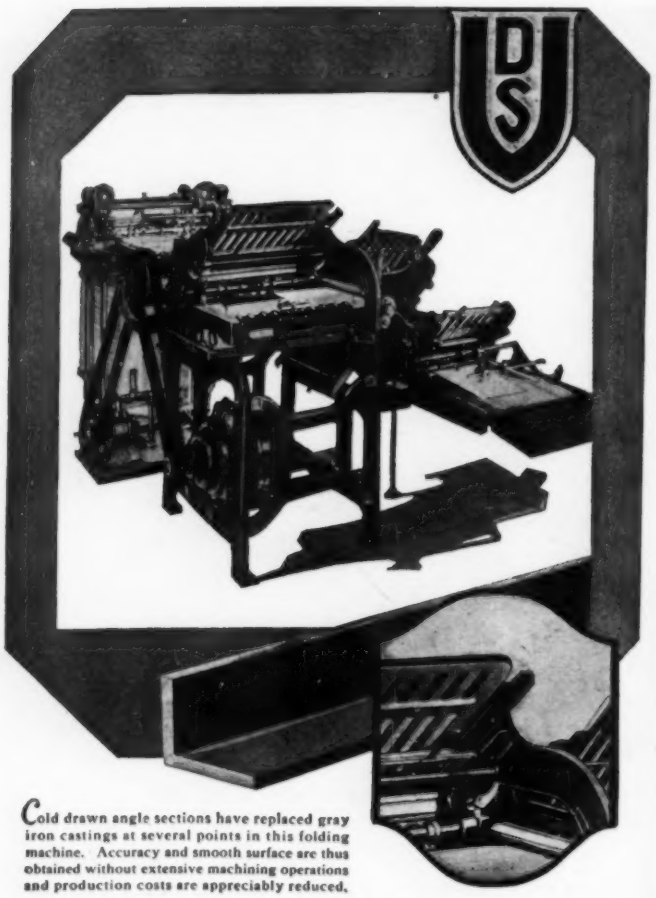
BAKELITE CORPORATION OF CANADA, LTD., 163 Dufferin St., Toronto, Ont.

BAKELITE

REGISTERED U. S. PAT. OFF.

THE MATERIAL OF A THOUSAND USES

"The registered Trade Mark and Symbol shown above may be used only on products made from materials manufactured by Bakelite Corporation. Under the capital "B" is the numerical sign for infinity, or unlimited quantity. It symbolizes the infinite number of present and future uses of Bakelite Corporation's products."



Cold drawn angle sections have replaced gray iron castings at several points in this folding machine. Accuracy and smooth surface are thus obtained without extensive machining operations and production costs are appreciably reduced.

Constant improvements in machine construction have created greater and greater demands *for Union Drawn Steels.*

UNION DRAWN STEEL CO.
Beaver Falls, Pennsylvania

UNION DRAWN STEELS

GOLF CLUB HEADS

in perfect condition the fourth year of heavy service and they have never been buffed

MADE OF

STERLING STAINLESS STEEL

STERLING STAINLESS

By the First Steel Company in America to produce Stainless Steel

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McKeesport, Pa

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PHILADELPHIA CHICAGO CLEVELAND
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W-14

ELECTRIC TOOL STEEL
High Speed Carbon
Highest Quality—Best Practice
Latrobe Electric Steel Co., Latrobe, Pa.

WOLFRAM HIGH SPEED STEEL

Vulcan
CRUCIBLE STEEL COMPANY
Aliquippa, Pa. Established 1900
Wolfram High Speed, Vulcan Special Vanadium, Straight Carbon and Special Steels. Uniformity and Vulcan are synonymous.

HAWKRIDGE BROTHERS COMPANY
ESTABLISHED 1893
STEEL
OF EVERY DESCRIPTION
303 CONGRESS STREET, BOSTON 9, MASS.
HAWK BRAND STEELS

for Better Marking
STEEL STAMPS
STENCILS
THE SCHWERDTLE STAMP CO.
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One Man Operates It--

Easily

No Tarzan—no Giant—not two men—but just one ordinary shopman is needed to force a row of *Clipper Belt Hooks* cleanly and uniformly into both ends of a belt up to 8 inches in width in 1½ minutes—if a *Clipper No. 8 SPEED Lacer* is used.

It seems fantastic that by a simple turn of a crank a machine so small and so compact can develop a pressure of 45,900 pounds on a belt surface. It seems more fantastic that an ordinary man can turn a crank that develops such power. Yet this can be done—and is being done—all over the country—every day.

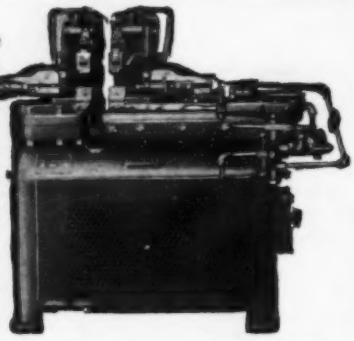
To join the ends of any belt up to 8 inches in width in 1½ minutes, a speed unequalled by any other belt lacing device, is a feat in itself. Yet it is just part of the every day work of the *Clipper No. 8 SPEED Lacer.*

Clipper Belt Lacer Company
GRAND RAPIDS MICHIGAN

Clipper
No 8 Speed Lacer

OUR wide experience in the practical problems of welding, plus the widest variety of Stock Welding Machines to fit every type of work, is the reason for Thomson leadership in this field.

Catalog and engineering help gladly extended upon request.



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1886 *"Pioneers in the Art of Resistance Welding"* 1926
361 Pleasant St., Lynn, Mass.

The Superior Quality of
"FEDERAL"
WELDERS
Has Never Been Questioned

Complete line of electric spot, butt and seam welders, standard or special

The Federal Machine and Welder Co., Warren, Ohio

Recognized leaders in the development and production of resistance welding machines.

WELDIT

Save 25% of Welding Gas!

Great corporations report savings in gas of 20 to 40 per cent and even more. The Weldit Gasaver acts as a rack for the torch, the weight of which shuts off the gas. When the torch is lifted the gas is released at the *same mixture* as before. Don't waste gas and adjusting time. Use the Gasaver.

Licensed under basic patents

Weldit Acetylene Company
636 Bagley Ave., Detroit

Cleveland, Ohio, Buffalo, N. Y., Syracuse, N. Y., Grand Rapids, Mich., Gary, Ind.

WELDIT GASAVER

Approved by the National Board of Underwriters

SWIFT ELECTRIC WELDER CO.

Manufacturers of
BUTT & SPOT WELDING MACHINES
Hand and Automatic

Office: Fort and Mt. Elliott, Detroit, Mich.
Factory: 817 S. Leighton St., Kenton, Ohio.

"LOGAN"
AIR OPERATED DEVICES

For every chucking requirement.
Adaptable to all types of machines.
Send for catalog R-22 for complete details.

THE LOGANSPORT MACHINE CO.
Sixth and Market Sts., Logansport, Ind., U. S. A.

"Sentry" Special Electric Furnaces

can be supplied for particular production requirements to operate up to temperatures to 2,400 deg. F. economically.

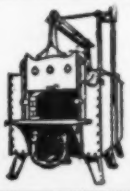
Whether you require a small bench model for the Tool Room, or an automatic furnace for Production Work, we can supply a size and model to exactly fit your needs.

The furnace shown was built for the production hardening of high-speed steel taps, dies, drills and other small tools.

Send for Bulletin No. 1008 and write us your requirements.

Sentry
"Always on Duty"

THE SENTRY COMPANY
Taunton, Massachusetts



S C & H
Industrial Furnaces
and Furnace Room Accessories

The Strong Carlisle & Hammond Co.
Cleveland, Ohio

STEWART
INDUSTRIAL FURNACES
FOR ALL PURPOSES

Chicago Flexible Shaft Co., 1156 S. Central Ave., Chicago
Branches: New York, Philadelphia, Boston, Pittsburgh, Rochester, N. Y., Detroit, St. Louis, Indianapolis, San Francisco, Milwaukee. Canadian Factory: 349 Carlaw Ave., Toronto.

For Maximum Efficiency
in Salt Bath Treatment

G & B No. E 315 Salt Bath Furnaces are so designed that the flame does not impinge on pot. Combustion takes place in separate chamber, the hot gases passing through ports into a heating chamber around the pot. This new G & B method of indirect heating is the secret of successful operation of the Salt Bath on production work.

Write for descriptive Bulletin.

Gilbert and Barker Mfg. Co.
EQUIPMENT FOR EVERY INDUSTRIAL HEATING NEED
Springfield, Mass.

JOHNSON GAS FURNACES
for
Heat-Treating—Soldering—Metal Melting

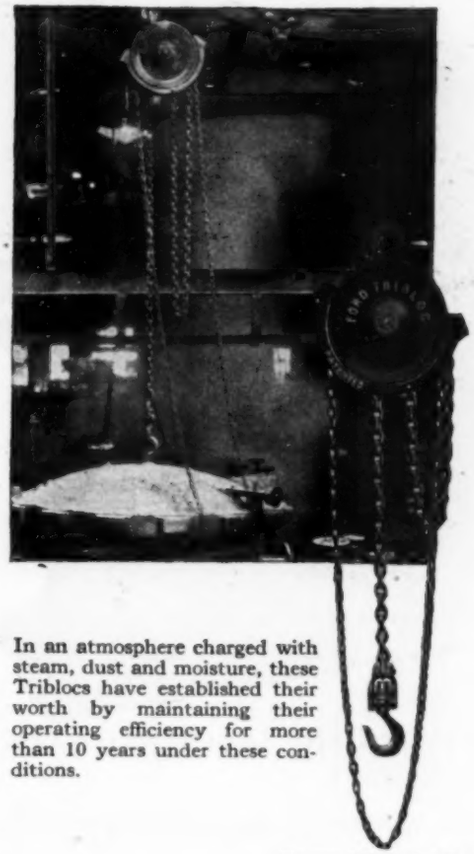
JOHNSON GAS APPLIANCE CO.
Cedar Rapids IOWA

AMERICAN GAS FURNACE CO.
PIONEERS IN 1878 LEADERS TODAY

Forges, Blowpipes, Gas Blast Burners, Furnaces and Heat Treating Machines for every industrial purpose.

Bulletin A.M.20 on request.

American Gas Furnace Co.
Office and Works: Elizabeth, N. J.



In an atmosphere charged with steam, dust and moisture, these Triblocs have established their worth by maintaining their operating efficiency for more than 10 years under these conditions.

The new Ball Bearing Shackle makes a Tribloc easier to use.

A helper not on the payroll

A Ford Tribloc is a mechanism that can be bought, installed and forgotten so far as maintenance is concerned—for thousands of Triblocs have endured for years in conditions that would soon ruin a hoist less sturdy or less resistant to wear.

Easily controlled, safe, swift and positive in action—Triblocs have properties that definitely reduce the number of payroll dollars exchanged for mere brawn. They are "helpers not on the payroll" in any interpretation of this sentence.

Send for Catalog 7-B.

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2nd and Diamond Sts., Philadelphia, Pa.

TRIBLOC
CHAIN HOIST

2386-D

HOISTS

Hand Chain or Electric

Harrington Hoists have been serving industry for over fifty years. That alone is a recommendation to their quality. They are carefully designed and ruggedly built to assure a long, active service life.

Peerless Hand Chain Hoists are made in six types, and in capacities of ½ to 20 tons. The Harrington Electric Hoist has a standardized housing and is built in capacities of ½ and 1 ton. For an all-purpose hoist in these capacities, this is ideal. It has 38 advantages, all of which are explained in Bulletin 40. Write for it.

Ask us about our complete line.

The Peerless Spurr Geared Hoist

The Harrington Electric Hoist

THE HARRINGTON COMPANY
PHILADELPHIA

No more trouble—

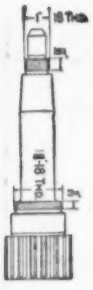
If you are having trouble in your thread cutting departments, we have something to offer that will eliminate it.

The Automatic Hob Thread Milling Machine is the result of many years' experimenting. It threads up to shoulders on parts six inches or less in diameter. Taper, internal and external threads are produced with equal precision and speed.

We show in this space, a few of the many parts that come within its range.

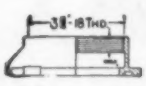
If you have threading troubles, let us see what we can do for you. Send us your blue prints for estimates on any of the

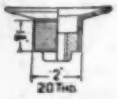
Coulter Automatics

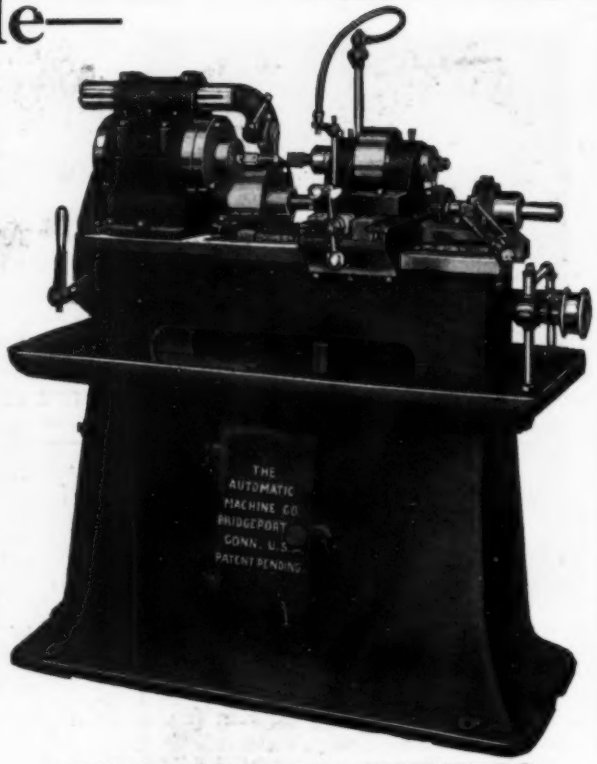


which include Thread Chasing Machines, Thread Grinding Machines, Profiling Machines, Combination Shaping and Planing Machines, Diamond Tool Boring Machines, Rubber Heel Press and Special Machine Tools.

Coulter Automatic Machines are increasing production in many prominent plants.







AUTOMATIC MACHINE CO.

Specialists for 29 Years on Automatic Production Machinery

115 E. Washington Avenue, Bridgeport, Conn.

Taper Keyseating on the GIANT

Keyseats in taper holes can be very easily cut on the **GIANT** Key-Seater by the use of taper bushings, a taper post or the solid bushings with a suitable wedge. It is only necessary that the side of the hole be fairly placed against the bushing faces. The keyseats in the taper hole, illustrated here, were cut in 40 minutes including all set-up time.

Full details of this system, in our catalog, on request.

MITTS & MERRILL, 913 Tilden St., Saginaw, Mich.

For screw machine economy, accuracy and big output

4 Sizes—Get Catalog

Cone Automatic Machine Co., Windsor, Vermont

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Chicago Representative: John H. Glover 2127 No. Sayre Ave.
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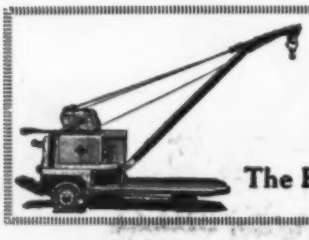
CONE AUTOMATICS

DAVIS KEYSEATER

This low cost machine will handle any keyseating job in the shop up to 1 in.

Write for illustrated bulletin.

DAVIS KEYSEATER CO., 255 Mill St., Rochester. N. Y.



Electric Industrial Crane Truck

One of 25 Types Each Built for Special Lift and Carry Service

Request Catalog 811

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Cleveland, Ohio

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PLANERS

THE CLEVELAND PLANER COMPANY, CLEVELAND, OHIO

SEND YOUR ELECTRIC HOIST INQUIRIES TO SHEPARD . .

Shepard Electric Crane & Hoist Co.
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Van Norman machine tool co.

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Performance like this speaks for itself!

"We ordered one machine for a tryout. After machine was in operation a short time, we found it so superior to the old way of doing the work we ordered two more machines."

Supt. GOETELMAN of the
APPLETON ELEC. CO.

285 PER HOUR!
½ and ¾ in. Unilets—Malleable Iron.

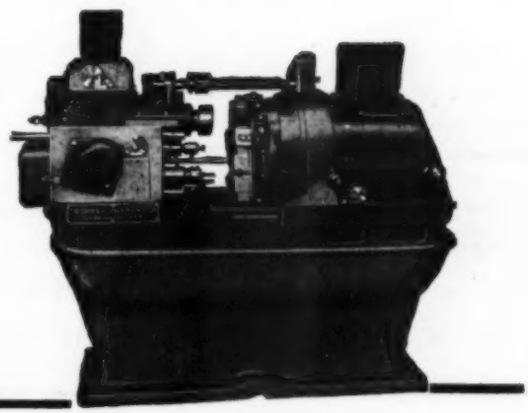
300 PER HOUR!
½ and ¾ in. Unilets—Malleable Iron.

BY A Straight 125%, the Appleton Electric Company, Chicago, Ill., increased output on these malleable cast iron outlet boxes, by putting them on the Goss & DE Leeuw Automatic Chucking Machine. That doesn't mean, either, that former methods were not up to snuff. They were. Hand-operated machines gave them 125 parts per hour, which jumped to 285 per hour when scheduled on this speedy five-spindle automatic chucking machine.

The Goss & DE Leeuw automatic is of the tool revolving, work stationary type. With the exception of a few seconds required to index the turret, there are no lost time elements. Loading takes place at the fifth chuck *while work is being performed.* Actual production time is the time of the longest operation. Setting the spindle speeds by change gears insures the most effective speed for every kind of metal and for every machining operation.

Turning, Boring, Threading, Tapping, Reaming on work up to 6 in. dia. x 6¾ in. long is the special province of the Goss & DE Leeuw Automatic.

Let us tell what this machine can do for you.



THE GOSS & DE LEEUW

Automatic Chucking Machines

The Goss & DE Leeuw Machine Co.

New Britain, Conn.

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Representatives: Henry Prentiss & Company —New York State, Northern New Jersey, Erie, Pa., Connecticut, Massachusetts.
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Cleveland Representative: S. B. Martin, 10612 Clifton Blvd.
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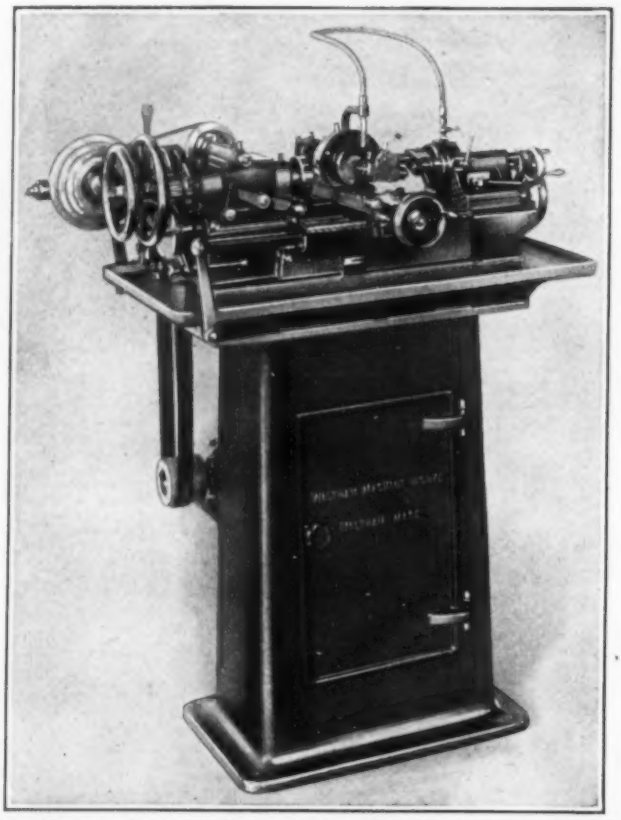
WALTHAM Semi-Automatic Thread Millers



Accurate in Threading Small Parts in Quantities

The New Waltham Thread Miller has revolutionized the quantity production of small parts to precise interchangeable standards.

The machine is semi-automatic. One man can handle a battery of them. We suggest that you have us prove to you that this new Waltham Thread Miller can effect big savings on your work.

Available for bench use or (as illustrated) mounted on a cabinet base.

We will gladly send complete details of this new Waltham Thread Miller on request.

WALTHAM MACHINE WORKS

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Foreign Agents—Buck & Hickman, Ltd., London; Fenwick Freres Co., Paris; Andrews & George Co., Tokyo, Japan; Andrews & George Co., Seoul, Korea; Andrews & George Co., Dairen, Manchuria.

Cam Milling Machines

with the Rowbottom name upon them, are your way to cams that require no touching up by hand. Send for a catalog today.

If your cam requirements do not warrant the purchase of one, you practically own a Rowbottom Universal Cam Milling Machine when you give our contract department the order to make your cams.

The Rowbottom Machine Co.
Waterbury, Conn.

KNIGHT MILLERS
MAKE PROFITS

Send for illustrated Catalog showing how they do it.

W. B. KNIGHT MACH. CO., ST. LOUIS, MO.

PLANETARY
THREAD MILLER

For milling the largest threads on a production basis.

The Hall Planetary Co.
Fox St. and Abbotsford Ave., Philadelphia, Pa., U.S.A.

SPLINE MILLERS
for closed end keyways and through slots.

VERTICAL MILLERS
with circular, contour, spiral and continuous milling attachments.

DRILLING MACHINES
1 to 7 spindles, hand, power and simultaneous feed. Heads, adjustable for variable distances between spindles.

PRESSES
Uniform blow, foot or power.

WET TOOL GRINDERS

***The* TAYLOR & FENN COMPANY**
Hartford, Conn., U. S. A.

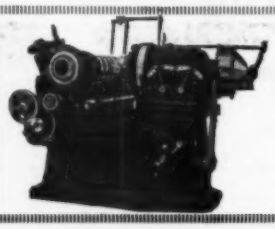
MILLERS **OHIO** **GRINDERS**

Plain Millers
Tilted Rotary Millers
Tilted Offset Millers
Tool and Cutter Grinders
Upright and Gang Drills
(Aurora Tool Works Division)

Profits which reach far into the future are insured by the progressive and far-seeing designs of all Ohio equipment.

Be sure and write for complete catalog.

THE OESTERLEIN MACHINE CO., Cincinnati, Ohio



Heavy Duty Worm Miller

Rapid, economical production. Heavy cuts, smooth, vibrationless work. Symmetrical tooth flanks and highest accuracy of lead attainable.

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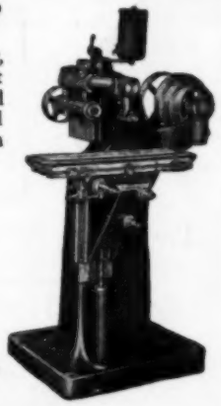
SCHUCHARDT & SCHUTTE OF NEW YORK
GEORGE SCHERR CO.
142-4 Liberty St., New York City.

Here's a good "don't"

Don't make the mistake of using big, expensive milling machines on light jobs, where the U. S. Improved Hand and Weight Feed Milling Machine will give you greater and better production at infinitely lower cost.

Don't! It isn't logical.
Bulletins on request.



The U. S. IMPROVED
Hand and Weight Feed
MILLING MACHINE

The United States Machine Tool Company
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Have the advantage of being the sole machine tool product of an organization of specialists. They possess correct design, unusual accuracy and are easy to operate. We make 14 in. Single Geared, 16 in., 20 in., 24-26 in. and 32 in. Back Geared Shapers. Write for a Catalog.

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P. O. BOX 488 XENIA, OHIO, U. S. A.

SHAPERS

simply designed but accurate and efficient

12-in. to 32-in. stroke (inclusive)
THE SMITH & MILLS COMPANY
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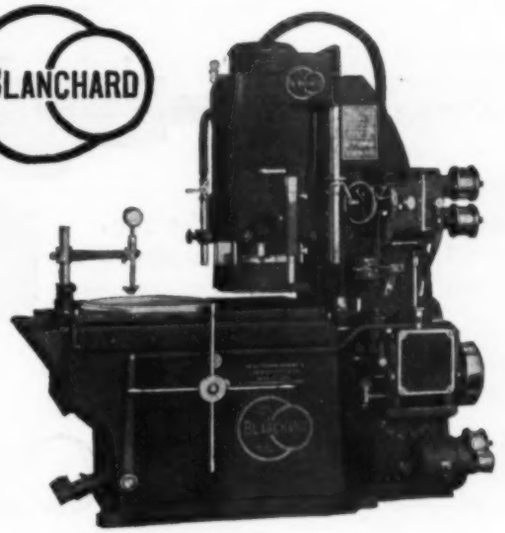
The direct way is to use the

BLANCHARD



No. 16 Blanchard Surface Grinder

THE BLANCHARD MACHINE CO.
64 State St., Cambridge, Mass.

Sharp Tools Cut Costs

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GRAND RAPIDS GRINDERS

GALLMEYER & LIVINGSTON CO.
346 Straight Avenue, S. W.
GRAND RAPIDS, MICHIGAN

The Walker SINGLE-STROKE Rotary Surface Grinder

increases production and eliminates spoiled work through its simple semi-automatic operation whereby all controls are operated through one lever. Equally at home on Toolroom or Production work.

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O. S. Walker Co., Inc.
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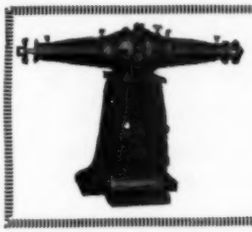

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Drills, Center Grinder, Hand Grinders.
Made in sizes from ¼ hp. to 15 hp.

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The Standard Electrical Tool Co.
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Hob and Tool Grinder

Automatically Indexed

Saves the time wasted in constant stopping, starting and indexing by hand. Hobs and cutters sharpened the full automatic way run true, cut evenly and maintain their correct profile. Can be operated by unskilled help. Five sizes for cutters up to 16 in. diameter.

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ABRASIVE SURFACE GRINDER

Either Horizontal or Vertical Spindle Type

Countershaft or Motor Drive

Get our bulletin for particulars.

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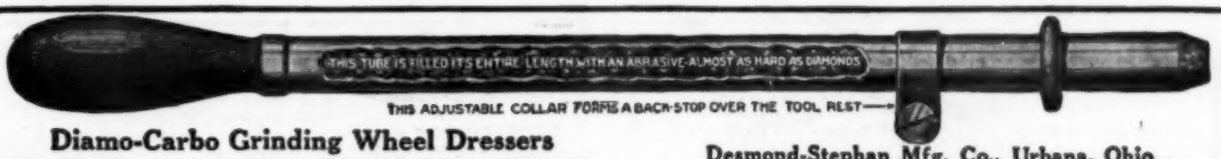

THIS TUBE IS FILLED ITS ENTIRE LENGTH WITH AN ABRASIVE ALMOST AS HARD AS DIAMONDS
THIS ADJUSTABLE COLLAR FORMS A BACK-STOP OVER THE TOOL REST

Diamo-Carbo Grinding Wheel Dressers

—consist of a steel tube filled with an extremely hard abrasive. For some purposes they are as satisfactory as diamonds—at only a fraction of the cost. Try them at our expense.

Desmond-Stephan Mfg. Co., Urbana, Ohio

New England Representative: George L. Gaylord, Westfield, Mass. Canadian Desmond-Stephan Mfg. Co., Ltd., Hamilton, Ontario. Alfred Herbert, Ltd., Coventry, England. Paris, Milan, Yokohama.

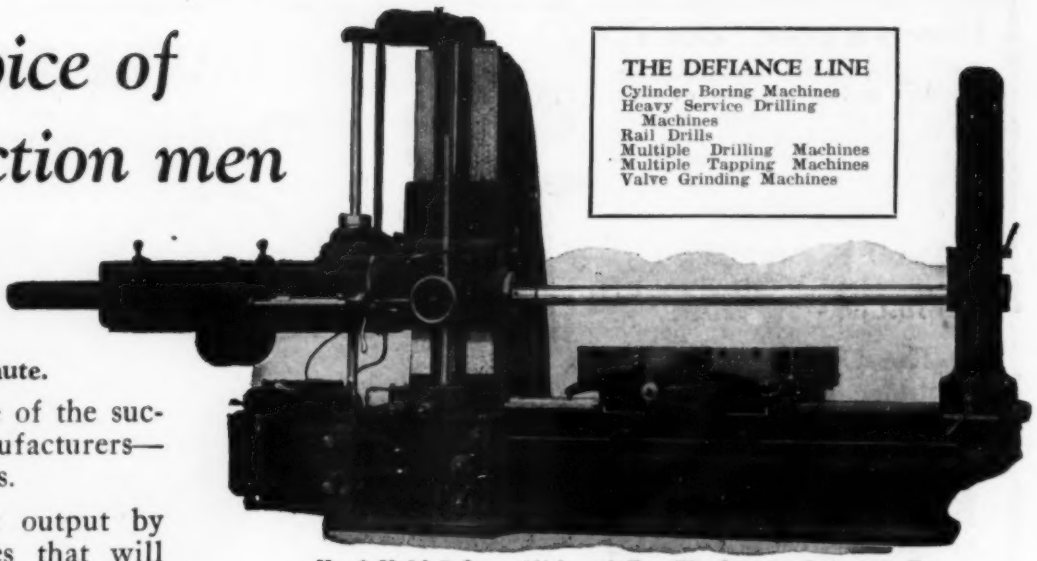
Our bulletin shows our complete line. Write for a copy.

The Choice of production men

Independent Power Rapid Traverse, both directions, for Head and Platen, giving 84 in. per minute.

Output is the cause of the success of leading manufacturers—output to close limits.

You can only get output by specifying machines that will produce.



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Cylinder Boring Machines
Heavy Service Drilling Machines
Rail Drills
Multiple Drilling Machines
Multiple Tapping Machines
Valve Grinding Machines

No. 6 Model Defiance 4½-in. spindle. We also manufacture smaller sizes—No. 5 with a 3-in. spindle, and 5A using a 3¾-in. spindle.

DEFIANCE

BORING—MILLING—DRILLING AND TAPPING MACHINES

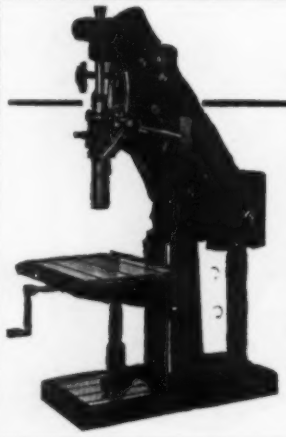
are setting the production pace at peak in the many plants where they are installed.

They are up to the minute in design and proven performers from every angle.

In their make-up you will find many features that insure continuous high output with minimum operating effort.

Write for bulletins and photos.

Defiance Machine Works, Defiance, O. *Since 1850*



The Ideal Tapping Machine

Self-Oiling All-Geared Tappers incorporate every feature that the ideal tapping machine should have—speed, accuracy, automatic reverse and productive capacity.

All gears and bearings fully enclosed and oiled automatically. No cone and no inherent belts to shift, slip, waste time and make trouble.

Write for Catalog "A".

BARNES DRILL CO.
(Incorporated 1907)
830 Chestnut St., Rockford, Ill.
U. S. A.

ANDERSON AUTOMATIC PRODUCTION TAPPING MACHINES

Speedy and almost human in their operation. Developed and sold by the Pioneers in Multiple Spindle Dial Feed Tapping Machines. On work such as illustrated the machine will tap up to 5 holes in different planes, parts turned or indexed automatically between tapping spindles—from 1800 to 2000 feet an hour.

Anderson Die Machine Co.
Bridgeport, Conn.

FITCHBURG

Plain Cylindrical, Universal and Valve Seat Grinding Machines.

FITCHBURG GRINDING MACHINE CO.
FITCHBURG, MASS., U. S. A.

LATHES **Blount** GRINDERS

Manufacturers of Grinders, Buffers, Speed Lathes and Manual Training Lathes.
For further information see larger "ads" 1st and 3rd issue of the month and write for catalog 22.
J. G. BLOUNT CO., Everett, Mass.

DICKINSON special shaped CARBON (black diamond) **Tools** for machining **Materials** of a **Hard, Tough** or **Gritty Nature** and where it is desired to maintain **Exact Uniform Size** and **Shape** in large numbers of pieces.

BORTZ DIAMONDS on account of their *Cleavage Formation* are easily fractured. CARBONS, (black diamonds) do not have this cleavage formation and will last for many years of continuous work.

THOS. L. DICKINSON, 38 Gold St., New York City
Successor to John Dickinson
Established 1700

Graduated Adjustable Friction Self-Centering

Tap Holders for Turret Lathe

TAPS STEEL as safely as Cast Iron

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MECHANICAL LABORATORY

Main Office and Works: Staten Island, N. Y.
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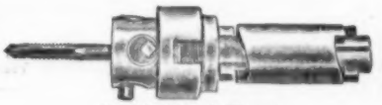
Regulates the Whole Power of Machine to Just Drive, but Cannot Break Tap. When Tap Sticks (or Strikes Bottom) the FRICTION SLIPS, and Tap can thus be Run In and Out until the Toughest Metal is Quickly Tapped.

Interchangeable Spring Shanks for Rough and Finish Taps occupying One Turret Hole.



Double Clutch Sleeve

Especially Good for Roughing and Finishing Taps, Running Solid Dies Up Against a Shoulder, etc.

Powerful—Accurate Radial Drills

Ask for Details

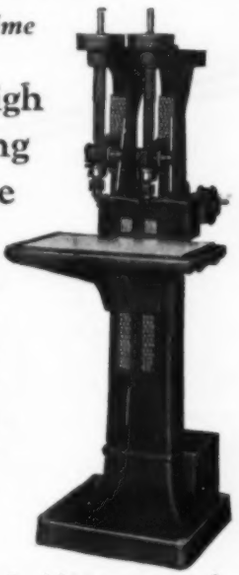
Every detail in design and construction that could possibly give Morris Radials more power to resist stalling or chattering under heavy feeds and high speeds has been incorporated into these productive machine tools.

We will gladly send complete details and descriptions on request.

The Morris Machine Tool Company
Cincinnati, Ohio

Built to Work Over-Time

Leland-Gifford High Speed Ball Bearing Drilling Machine



All high speed parts perfectly balanced, practically eliminating vibration. Every moving part absolutely true and accurate. Free use of high grade ball bearings insures continuous satisfactory performance.

Leland-Gifford Drilling Machines are made to meet every individual production requirement.

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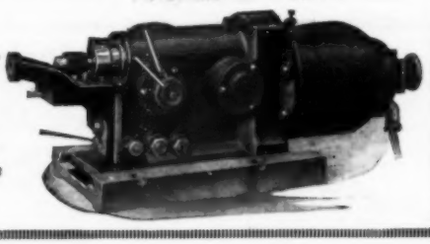
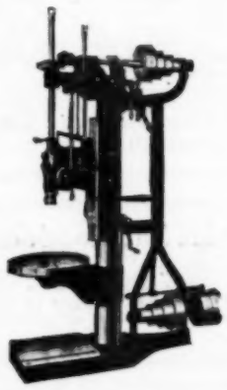
AUTOMATIC DRILL AND TAP HEADS

Serve as the nucleus of the most economical types of high production drilling and tapping machines.



KINGSBURY MACHINE COMPANY
Keene, N. H.

Originators of the Automatic Drill Head Unit.



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Stationary and Sliding Head

8 to 50 inch Swing

Established 1872

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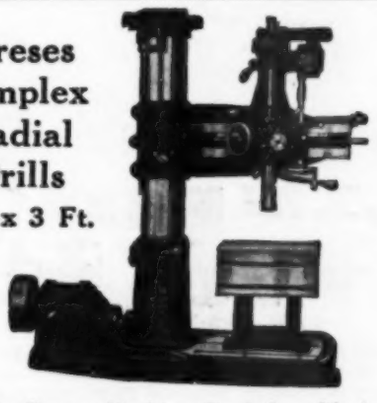
Dreses Simplex Radial Drills

2½ x 3 Ft.



A Drill That Invites Comparison with Any of Its Type.

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When you buy a drill consider this—

Consider purchase price, consider range of utility, power cost, and service life. When considered on this basis, Canedy-Otto Drills stand out as economical, efficient drills.

They are simple, practically vibrationless, strong, and are operated with a smaller sized motor than has heretofore been practical.

The two drills shown here are typical. Study their features. Write for full details.

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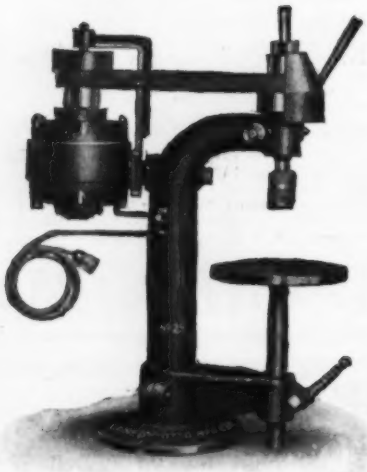
Complete stock carried at branches.

The C. O. 14-inch Sliding Head Sensitive Drill shown here was designed for great flexibility and speed. It is equipped with Timken Roller Bearings. All the flexibility and convenience of operation possible has been built into this machine. Capacity is ½-in. with spindle speeds of 400, 850 and 1,750 r.p.m.



READY FOR THE JOB

READY FOR THE JOB

The Canedy-Otto No. 29 Sensitive Bench Drill has self contained Motor Drive. It is equipped with 3-step cone pulley having a maximum spindle speed of 3000 R.P.M. It is really a Semi High Speed Drill. Capacity is ⅜-in. with spindle speeds of 720, 1,430 and 3,000 R.P.M.

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Hollow Milling Machines

with Hopper Feed

Hoppers

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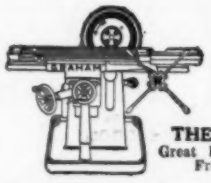

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Also Fox "Superflex" Power Presses

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DRILLING Machines of all types—Gang Drills, Sensitive Drills, Sliding and Stationary Head Drills. Horizontal Drilling, Boring and Tapping Machines, Multi-Spindle Auxiliary Drilling Heads, etc.

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Rockford, Ill.

Five Years Satisfaction

The Carlton All Ball Bearing Radial Drill pleases its users. Has done so for **FIVE YEARS** and will continue to do so. Learn all its features and you'll see why.

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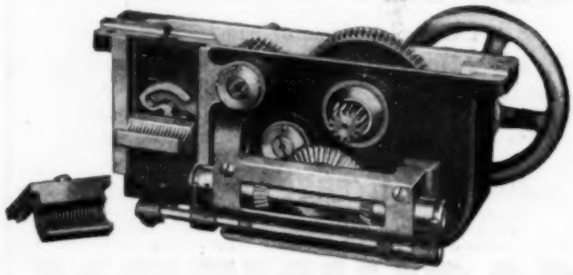
A prime factor—the Spindle

A correctly designed, properly machined spindle is one of the biggest factors in lathe accuracy.

The *Spindle* in the Porter-McLeod Geared Head Lathe is of forged chrome nickel steel, machined from the solid. It is ground to accurate standard sizes and is thus interchangeable. Its bearings are made of phosphor bronze.

The spindle has recently been improved by providing a pilot 1/16-in. greater in diameter than the threaded portion and ¾-in. long, and also by providing a shoulder 3-in. in diameter next to the bearing. These new features insure greater accuracy and interchangeability when fixtures are mounted on face plate.



Porter-McLeod Geared Head Lathe

13 in. and 15 in. Sizes

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of the Porter-McLeod Geared Head Lathe has many new and novel features. Full details will give you new ideas in lathe design. They are all in the Circulars.

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Tri-Way Type

For Close Accuracy, and Large Production

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This particular head drills 12 holes at a time. But we make any type to suit any particular need.

Let us know your particular problem.

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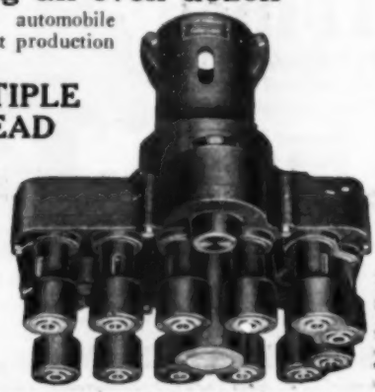

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Their "minute-saving" features of design will greatly increase your drilling output and profits. Get the complete details from our branches in the principal cities.

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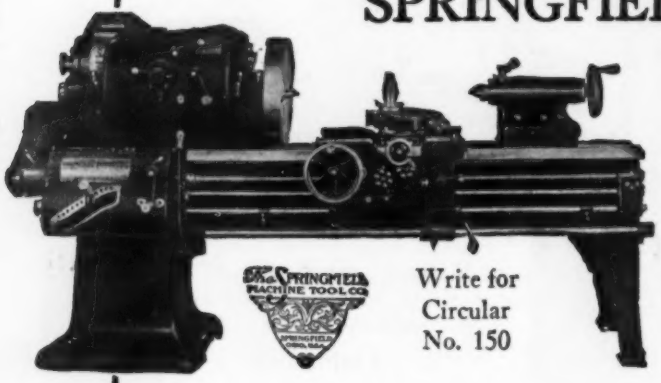
SPRINGFIELD BALL BEARING GEARED HEAD LATHES



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Money Makers on Every Job

Lathe efficiency is determined by the margin of profit made possible on every job.

If you are looking for a lathe with real money-making features, let us give you all the details of the improved Springfield Ball Bearing Geared Head Lathe.

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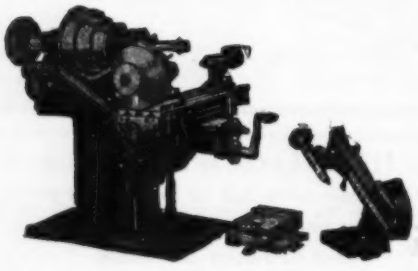
Cataract Precision Lathes & Millers



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Bench Miller

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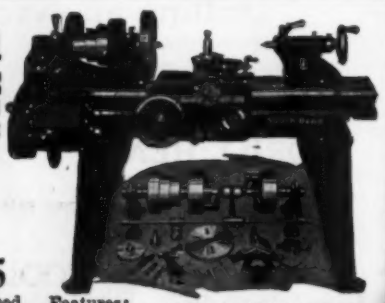
Precision LATHE for the Tool Room and Manufacturing Plant



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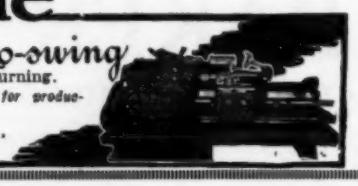

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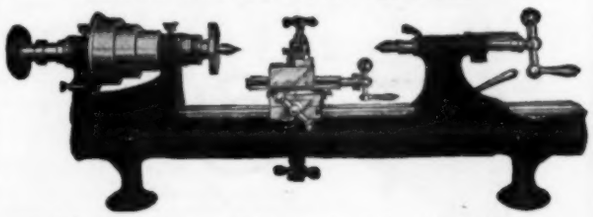

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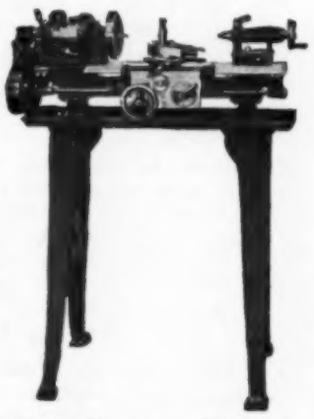

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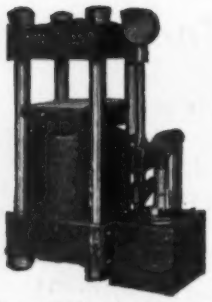

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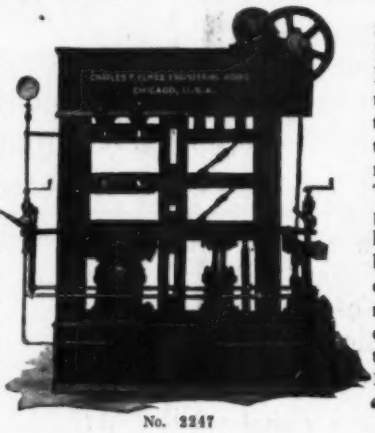

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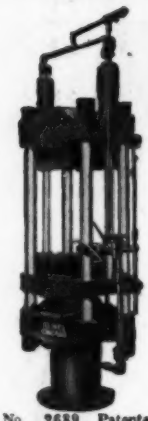

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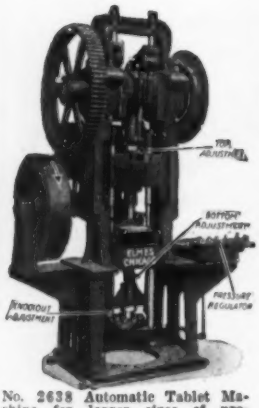

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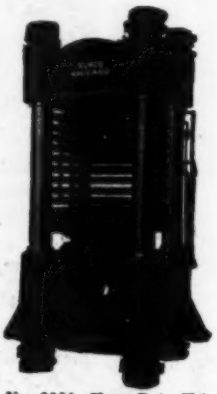

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Stop wasting high-priced labor!—

Bilton's *Ready-Made* Die Sets save from 30% to 50% of the cost of making your own. They are infinitely better than those made in the average shop. With semi-steel castings, generously proportioned; hardened and ground liner pins; steel bushings finished to plug gauge limits; they facilitate set-up and resharpening.

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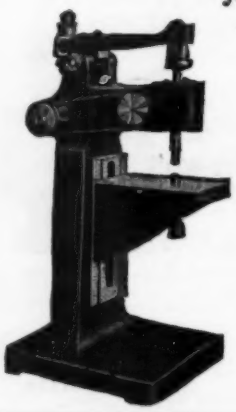
Just the thing for small riveting



This rotating vibratory riveter is a light bench model that will speed up your production on small riveting up to ¼ in. diameter. Easily operated by an apprentice or the most inexperienced female labor.

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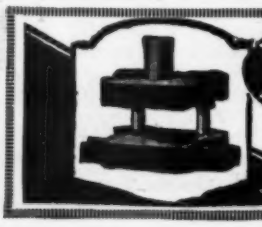

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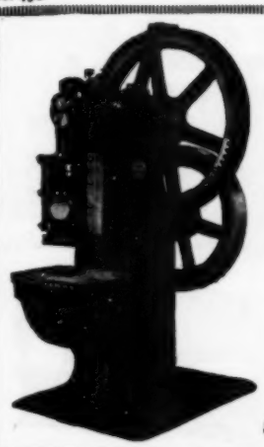

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Punch Presses

Sturdy tie-rod construction assures long life for press and tools, with expedition and accuracy of performance in punching, bending, forming and perforating operations.

ADRIANCE MACHINE WORKS,
INCORPORATED
84 Richards St., Brooklyn, N. Y.

U. S. TOOL ~ *Steel*

SUB PRESS ~ ~

Immediate Delivery from Stock

Our big stock of all styles and sizes of U. S. Tool *Steel* Subpresses enables us to guarantee prompt shipment of your order on its receipt.

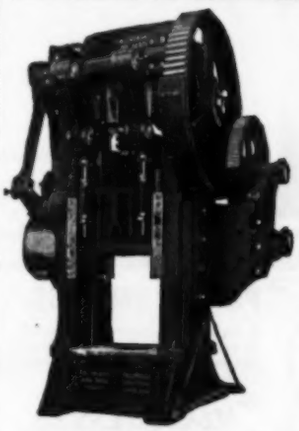
Styles, Sizes and Prices on Request.

U. S. TOOL COMPANY, Inc.
Manufacturers and Engineers
AMPERE (Newark), N. J.

THE

"TOLEDO"

Single and Double Crank Toggle Drawing Deep Stamping PRESS



"TOLEDO" Patented Toggle Drawing and Deep Stamping Press Series No. 160

Presses for Every Purpose

"TOLEDO" Patented Toggle Presses, built in 50 sizes (7,500 to 650,000 lbs.) are widely used for drawing stamped steel and enameled ware, seamless steel bath tubs, metallic caskets, auto radiator casings, fenders and similar parts, mail boxes, vending machines and innumerable other objects made from copper, brass, aluminum, steel or tinplate.

The chief merit of these machines, built both in single and double crank types, resides in the blank-holder control mechanism which not only insures a perfect dwell, but eliminates wastes due to undulating or yielding.

Estimates furnished—Correspondence solicited

The Toledo Machine & Tool Co.
Toledo, Ohio

Chicago Office: Room 611 Machinery Hall, 549 W. Washington Blvd. *Detroit Office:* Room 1, 250 General Motors Bldg. *European Representatives:* United Kingdom, Burton, Griffiths & Co., Ltd., 70 Vauxhall Bridge Road, London, S. W. 1., England. Allied Machinery Company, Paris, Turin, Zurich, Barcelona.

Send for this free booklet—

If you saw metal, you'll be vitally interested in this booklet. It describes the New Peerless Universal Metal Saws that cut faster than ordinary power saws with Milling Cutter accuracy, and at the same time doubling the life of the blade.

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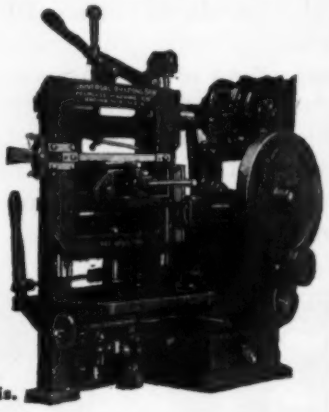
Peerless U. S. A. Power Blades have some exceptional production records back of them. Try out a dozen. Also makers of Peerless Duplex Hand Blades, and Peerless Gauging Drill Racks.



Capacities
6x6", 9x9" and 13x13"

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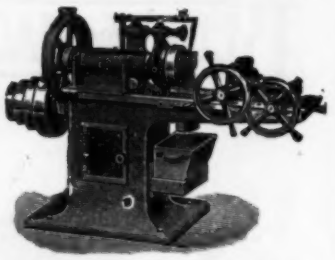
1218—16th Street, Racine, Wis.

Peerless HIGH SPEED
Metal Sawing Machines
Modern Equipment Cuts Costs

With Acme Bolt Cutters

You can adjust the dies to size without stopping the machine. The bolt cutters are fitted with Acme Die Heads. The dies are made interchangeable with the steel caps and the Die Heads are all lined with hardened tool steel and ground to size. Dies can be changed in less than a minute.



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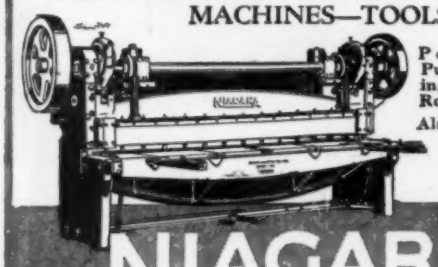
Cleveland, Ohio, U. S. A.

Exclusively Since 1879
SHEET METAL WORKING MACHINES—TOOLS and DIES



Power Presses, Punches, Squaring Shears, and Rotary Shears.
Also complete line of shop machines and tools.
Write

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THE HIGH SPEED RIVETING HAMMER
(Patd.)

Cold Riveting
1/64 in. to 1¼ in. in diameter

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17 STYLES AND SIZES
MERRELL
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TOLEDO, OHIO

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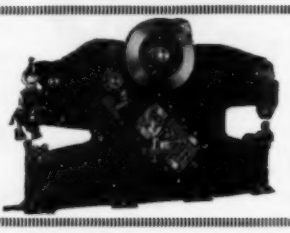
Bar Cutters



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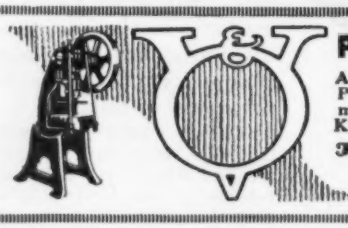

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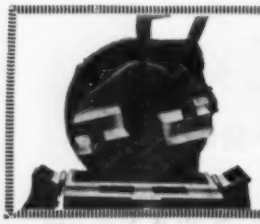
A complete range of Punch Presses, including dial, magazine, roll feeds, and King Pressure Toggles.

The V&O PRESS CO
HUDSON, N. Y.



Rotary Cutting-Off Machine
Employing two balanced cutting tools rotating around the work, which is held stationary.
3 in. round cut off in 45 seconds.
2 in. steel tube cut off in 13 seconds.
SCHUCHARDT & SCHUTTE OF NEW YORK
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DIE MAKING MACHINE
"Saves an average of 50%"
"We wonder how we ever got along without it."
Dies, templets, experimental parts, gages and the like can be sawed, filed and lapped on the Oliver of Adrian Die Making Machine much easier, more accurately and in a fraction of the time ordinarily required for handwork.
Our Bulletin tells the whole story.
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Looking for Better Hack Saw Blades?

Marvel High-Speed-Edge Hack Saw Blades

Will Fill Your Requirement

The genuine high speed steel cutting edge and the back that will not break in any machine form an unbeatable combination. The long life of the genuine high speed steel teeth and the unbreakable feature of

Marvel High-Speed-Edge Blades

is the final and logical solution of better hack saw blades.

The old worry about breakage is eliminated. No need to look further. Once tried you will want no other. A trial of Marvel High-Speed-Edge Blades will convince you of their superior merits.

Made in 12, 14, 17, 18, 21 and 24 inch lengths
6, 8, 10 and 14 teeth per inch in all lengths

Write us to-day. Ask for special circular showing how Marvel High-Speed-Edge Blades will help you.

ARMSTRONG-BLUM MFG. CO.

347 N. Francisco Ave., Chicago, Ill.

WHITON LATHE CHUCKS

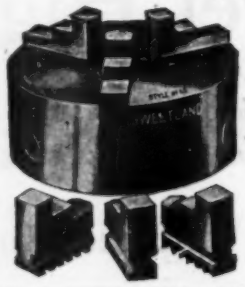
Combination Chucks

Complete lines of Independent, Universal and Combination Chucks. Light, medium and heavy weights. Iron or steel bodies.

Price and dimension list on request

THE D. E. WHITON MACHINE CO.
Established 1856
NEW LONDON CONN.

SWEETLAND CHUCKS



The "Old Hand's" choice

Because he knows what it means to have a reliable chuck; a chuck that will retain its accuracy and grip year in and year out; a chuck that needs no "fussing," simple and positive in operation. Because he's probably used Sweetland Chucks as long as he can remember.

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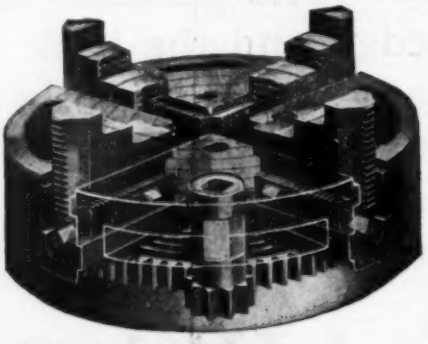
New Haven, Conn.



Westcott Combination Chucks

Increased Production in one shop

20%

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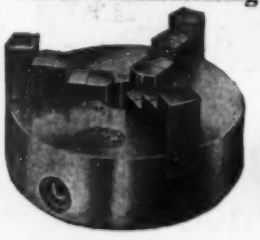
WESTCOTT CHUCK Co.

316 E. Walnut St.
Oneida, N. Y.

We Make Nothing But Chucks

Union Chucks are always "up to the minute." Our best efforts are devoted to the development of chucks and every dollar expended in a Union assures ample returns in service. Correct design and proper materials give Union Chucks the stamina to stand hard usage.

Union Manufacturing Co. **New Britain, Conn., U.S.A.**



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New York Office: 26 Cortlandt St.
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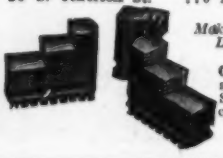

Makers of a Complete Line of Chucks

Our Catalog shows full line. Send for your copy.

AUTOMATIC CHUCKS AND TAPPING ATTACHMENTS

WAHLSTROM TOOL CO.

5524 SECOND AVE.
BROOKLYN, N.Y.

Optical Measuring

Quantity production is governed with an "iron fist" by the precision with which component parts can be held to specific accuracy limits. Inaccurate gauges and uncertain measuring aids will unfailingly break up production, causing great financial loss.

Carl Zeiss optical measuring tools detect errors and indicate these errors precisely the same to every human eye.

SCHUCHARDT & SCHUTTE OF NEW YORK
GEORGE SCHERR CO.
142-4 Liberty St., New York City.

Model 50

FEDERAL
Dial Indicators
A New Feature
Jewelled Bearings

are an exclusive feature of Federal Dial Indicators. Indicators equipped with this new improvement last longer and preserve the accuracy of the readings for the life of the instrument.

Catalog Describing Complete line of Dial Gauges on Request.

Federal Products Corporation
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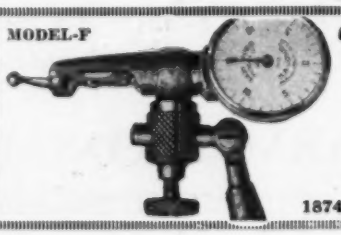
Automatic Numbering Heads will prove economical

for serial numbering on parts made of steel, brass, wood, fibre, etc., such as name plates, metal tags, machine parts, etc. Made to order in any style or size of figures. Write for particulars.

THE NOBLE & WESTBROOK MFG. CO.
Manufacturers of Rapid Production Marking Machines, Steel Stamps and Marking Dies, Brass Checks, etc.
Hartford, Connecticut, U. S. A.

MODEL-F



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UNIVERSAL
Test Indicators

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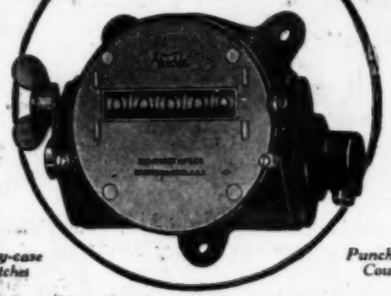
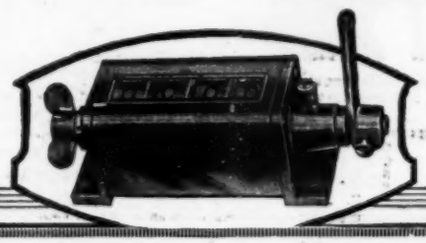


Heavy-case Ratchet

Punch Press Counter

MACHINE production "gets a move on" when your machine gets a Counter on. Nothing but work or actual *output* moves the figure-wheels of a Counter. That's why the output moves steadily *UP* when you require that it register on a "*VEEDER.*" Write for booklet.

THE VEEDER MFG. CO., 15 Sargeant St. Hartford, Conn.



SLOCOMB
Direct Reading Micrometer

YOU READ IT DIRECT

Saves Time—Prevents Errors

Counting device is compactly designed and placed to insure perfect balance. Micrometer is held in one hand and operated in the usual way.

"The Longest Lived Micrometers That Can Be Bought" are all fully described in the Slocomb Measuring Book. Write for a copy now.

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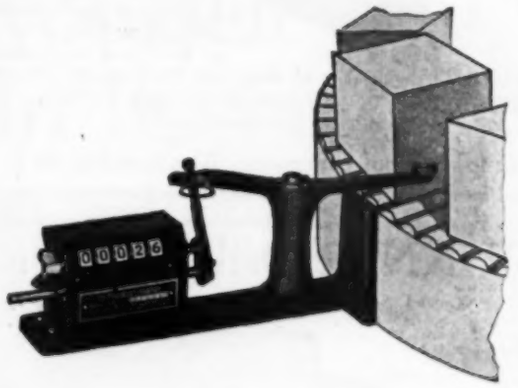
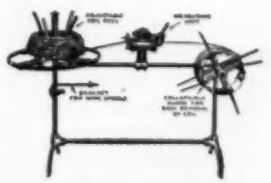
Count Your Product
Automatically

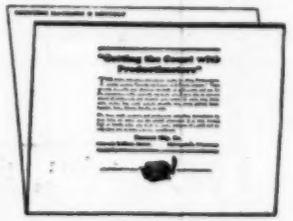


No matter what form it may have,—boxes, bundles, bales, bags, cases, pieces or packages,—it can be counted quickly and easily, with automatic accuracy. The Productimeter Conveyor Counter illustrated, for counting cases or pieces as they pass along a conveyor, is a representative Productimeter counting unit of which there are 60 different types for application to various machines. Write for Bulletin No. 2, giving complete description of the Productimeter Conveyor Counter.



DO YOU USE WIRE?

Then stop its waste by measuring off accurate lengths as needed, with the Productimeter Lineal Measuring Reel. Measures and coils the wire at the same time. Also useful for cord, rope, tape, trimmings, or other lineal material. Complete details in Bulletin No. 3.



SEND FOR THIS HANDY REFERENCE FOLDER:

containing full information on Productimeters and counting machines, their application and use.

DURANT MFG. COMPANY
660 Buffum Street, Milwaukee, Wis.

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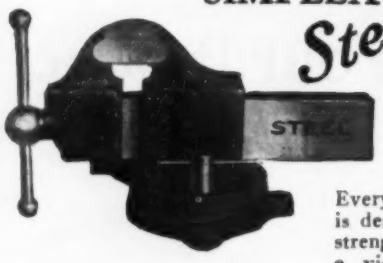
Productimeters
THE SPEEDOMETERS OF INDUSTRY

SIMPLEX *Steel Slide* VISES



Every part of the Simplex is designed for maximum strength and the result is a vise that is 3 times stronger. The special steel slide and the forward jaw cast integral with the slide are some of the main features.

Ask for details and prices

Simplex Tool Company, Woonsocket, R. I.

REED VISES

Almost Never Break

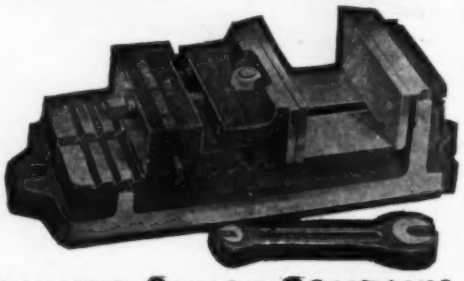
Last many many years

—Reed Vises are the most rigid you can buy. Their extra-rigidity insures more satisfactory service.

Reed Manufacturing Co., Erie, Pa.

SKINNER Drill Press Vise

Truly "The Handy Tool"



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ESTABLISHED 1887

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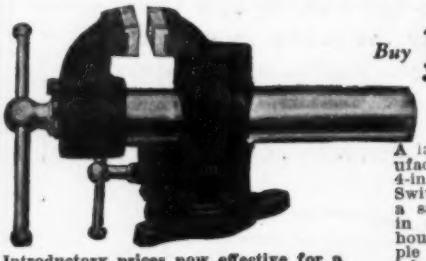
FOR Efficiency—Rigidity—Durability



Buy The DROPFO VISE

Made entirely of drop forgings

A large automobile manufacturer now using 250 4-in. Dropfo Wedgelok Swivel Vises has effected a saving of 15 minutes in time in each eight-hour day due to the simple and positive Wedgelok principle. The vise pays for itself thru this feature alone in 30 days.

Write for Contract Prices

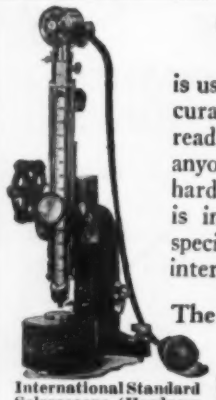
The Fulton Drop Forge Company
Canal Fulton, Ohio

Introductory prices now effective for a limited time only.

Size	Jaw Opening In	Weight Lbs.	Price Swivel	Stn.
3 inch ...	5½	22	$ 8.00	$ 7.00
4 inch ...	6	35½	11.00	10.00
4½ inch..	8	45	14.00	13.00
5 inch ...	8	54	16.00	15.00

Above prices F.O.B. Canal Fulton, Ohio

The Scleroscope



International Standard Scleroscope (Hardness Indicator)

is used in hundreds of plants for its accuracy in **hardness testing.** It is direct reading and can readily be operated by anyone. Ranges from softest metals to hardest steels without adjustment. It is invaluable in ordering material to specifications. Our free booklet will interest you.

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Van Wyck Ave. and Carll St.
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DRILL VISES | **DRILL SPEEDERS** | **KNURL HOLDERS** For Turrets

THE GRAHAM MFG. CO., Providence, R. I.

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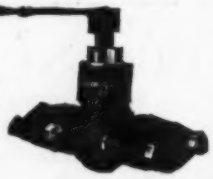
CARL ZEISS OPTICAL GEAR TOOTH MICROMETER

Direct reading by magnified glass scales of chordal thickness and addendum of tooth. 1/1000 in. looks like 1/16 in. apart. No vernier—no lines to count—no confusion—no calculation—no errors.

GEORGE SCHERR COMPANY
142-4 Liberty St., New York.

HYDRAULIC VALVES AND FITTINGS

Watson-Stillman valves are designed to perform their functions with ease and safety. The materials are the best obtainable, and each valve or fitting is tested to a safe overload.



Our line embraces an almost endless number of combinations designed to meet the varied requirements of hydraulic systems.

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Cleveland, Detroit, Chicago
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Twist Drills, Reamers

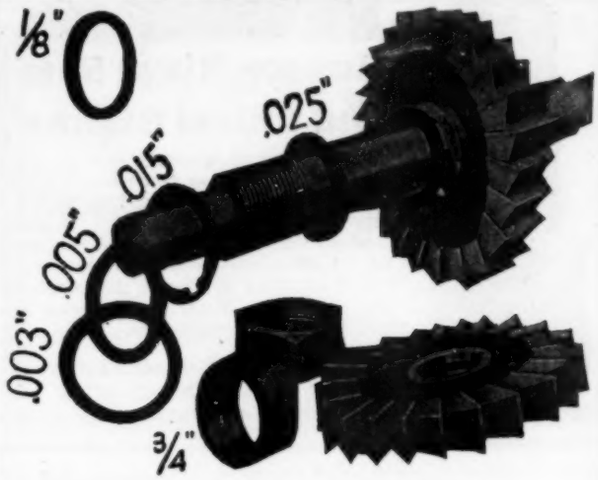
See our Page advertisement, Dec. 1st issue.

Screw Extractors

The CLEVELAND TWIST DRILL COMPANY CLEVELAND

TWIST DRILLS, CUTTERS, REAMERS AND SPECIAL TOOLS

NATIONAL
TWIST DRILL & TOOL CO.
DETROIT, U.S.A.



Steel Spacing Washers

Send for free assortment in the sizes you use most. Stock sizes for arbors of the following diameters:

⅜, ½, ⅝, ¾, ⅞, 1, 1⅛, 1¼, 1⅜, 1½, 1⅝, 1¾, 1⅞, 2, 2¼, 2½, 3, 3½ and 4 inches and larger.

Stock Thicknesses: .001, .002, .003, .004, .005, .006, .007, .008, .010, .012, .015, .020, .025, .032, .047, .063, .093, and .125 inch.

Spacers thicker than ⅛ in. are turned from tubing but not carried in stock.

Prices and Samples on Request.

Detroit Stamping Company

3445-3459 West Fort Street, Detroit, Mich.

Getting Oil and Grease Off Quickly

Use one of our Soda and Potash Kettles for cleansing your newly-made machine parts. And for removing paint, dirt and grease in repairing automobile and machinery parts. Cheaper than gasoline and less dangerous. It has many other uses. *Send for circular and prices.*

The Gray & Prior Machine Company

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Use **Casler Offset Boring Heads**

to reduce cost of jigs, fixtures and experimental work and **Casler Twin Screw Drill Chucks** to reduce cost of manufacturing.

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HERMAN CASLER, Canastota, N. Y.

Well balanced
Perfect grip
Safety and
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How to get results for yourself in business

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WHAT is it that gets results in business? How is it that one man finds success, while his next-door neighbor, just as able, just as intelligent, runs along to, mediocrity or failure? Why do we see men with exceptional ability forced to watch others far less able pass them on the business ladder?

The answer, nine times out of ten is PERSONALITY. The successful man gets himself believed in and accepted. The successful man thinks straight, writes effectively, speaks persuasively, knows how to get the support of others and makes the most of every ounce of ability he possesses, as every man should, as every man can.

The methods of hundreds of successful executives are given in these five volumes. Every one of them fits into your day's work. Every one of them can be put to profitable use. They show you how to get results in business.

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PERSONAL EFFICIENCY

in Business

5 volumes. 1158 pages, $10.75, payable $2.75 in ten days and $2 a month for 4 months.

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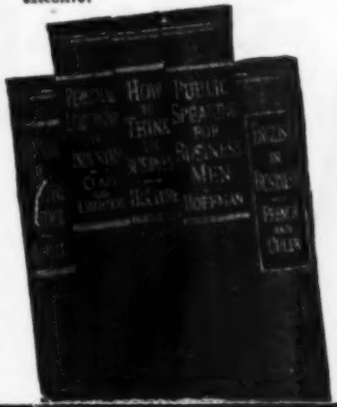

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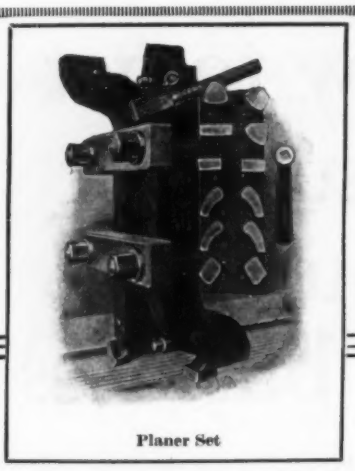

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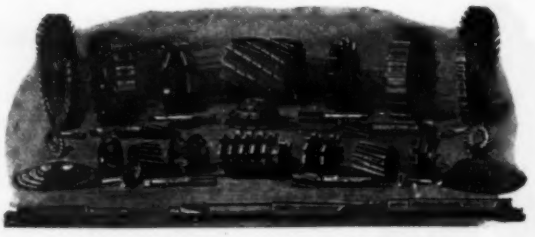

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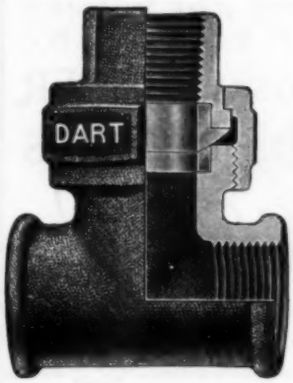

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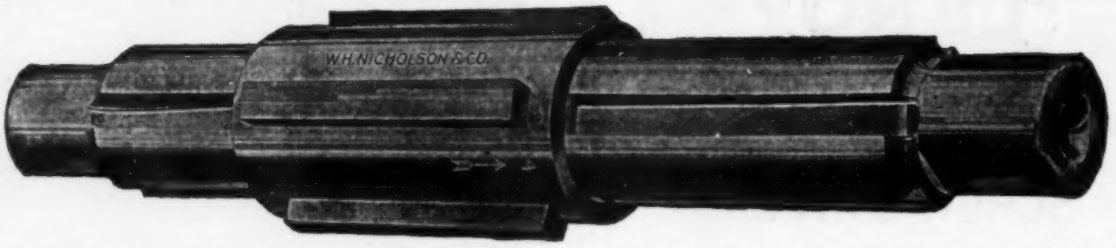

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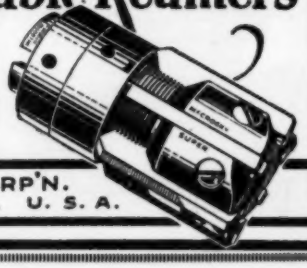

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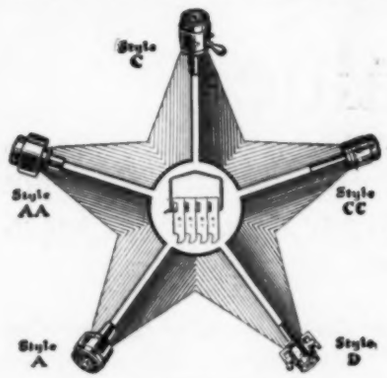

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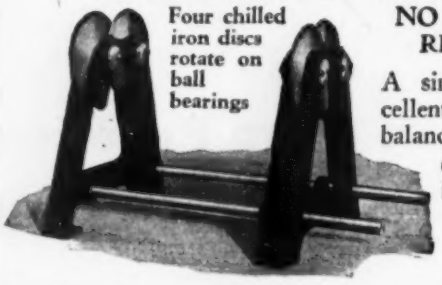

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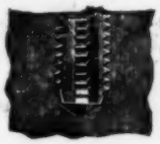

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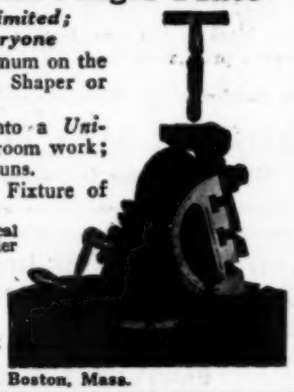

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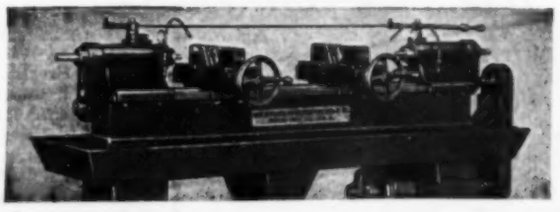

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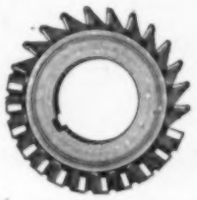

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Solid End Mills
Slitting Saws

Cutters are held to the largest possible diameters and widths or are reduced to the next standard size side and plain mills up to 12 in. diameter and 12 in. face and saws to 61 in. diameter are efficiently handled.

REAMERS

Straight Flue (solid above ⅝ in. and shell above 1¼ in. diameter).
These we restore to original diameters, or if they are worn more than .020 below size, they can be reduced to specified or standard sizes.

REAMERS

Spiral Pilot or those of Special Design
We will, upon receipt of Blue Print or sample, furnish complete data as to their salvage possibilities.

DRILLS

STRAIGHT OR TAPER SHANK
All kinds, ⅛ in. or larger, can be reduced to the next standard size.

HOBS

High Speed Hobs made into Slab Mills or Shell End Mills.

SPECIAL

Special Tools of all types made standard.

National Tool Salvage Co.
Detroit, Mich.

THE CHAS. FISCHER SPRING COMPANY
Round and Flat Springs, Wire Forms, Flexible Shafts and Tubing, complete Mechanical Assemblies.
240 KENT AVE. BROOKLYN

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USED MACHINERY & NEW—BUSINESS OPPORTUNITIES

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An advertising inch is measured vertically on one column, 3 columns—30 inches—to a page.

A.M.

POSITIONS VACANT

Pennsylvania

DESIGNING engineer for designing recording and automatic controlling instruments for power plants, chemical works and other industries; must be capable of applying laws of physics in development of instrument designs, working out simple designs for complicated mechanism and of designing apparatus for factory production; plant located in Philadelphia; give personal history and qualifications in first letter, including recent photograph. P-759, American Machinist, 1600 Arch St., Phila., Pa.

Rhode Island

ENGINEER, technically trained, with shop experience, wanted by a New England manufacturing company for experimental, development and research work involving a large and varied number of subjects. P-757, American Machinist, Tenth Ave. at 36th St., New York.

EMPLOYMENT SERVICE

IF YOU are qualified for position between $2,500 and $25,000 and are receptive to negotiations for new connection, your response to this announcement is invited. The undersigned provides a thoroughly organized service, established seventeen years ago, to conduct confidential preliminaries, and assist the qualified man in locating the particular position he desires. Not an employment agency. Retaining fee protected by refund provision, as stipulated in our agreement. Send name and address only for description of service. B. W. Bixby, Inc., 266 Main Street, Buffalo, New York.

AMERICAN ENGINEERS SERVICE, EMICH BUILDING, PITTSBURGH. Requires for extended employment proposals: Mechanical superintendents, designers, tool draftsmen; machinery, engines, motors, valves, pumps, presses, metal products, all lines.

$3,000.00-$30,000.00 men find our service effective in making connections. Individual. Confidential. Refund agreement. Not agency. Jacob Penn, Incorporated, 9 Park Place, New York.

MEN who are interested in securing a new position can receive valuable information from this company. A national service—not an employment agency—is maintained through which confidential contact can be made with national organizations. This service is individual and professional and does not hazard your present position. Your identity is protected. You are further protected by our refund agreement which will be explained in our first letter. Correspondence of those interested is invited. National Vocational Service, Hendricks Block, Suite B, Syracuse, New York.

WANTED

Tool and Die Designers

Experienced in designing for quantity production to close limits. Steady employment.

Employment Dept.,
The National Cash Register Co.
Main and K Sts., Dayton, Ohio

WANTED

DRAFTSMEN

With tool and die designing experience for work on small interchangeable parts.

ROYAL TYPEWRITER CO.
150 New Park Ave., Hartford, Conn.

EMPLOYMENT AGENCY

WE need at once a first-class designer, experienced on drilling machines. Also designer for machines similar to box pasters. Other openings for high-grade designers and draftsmen. Consolidated Agencies, Inc., 110 South Dearborn St., Chicago, Ill.

POSITIONS WANTED

Michigan

MODERN, practical shop executive, 41, wide experience and real producer on production, well versed in tool work and machine construction, qualified to act as assistant to works manager or superintendent small shop in every detail. E. E. Erbe, 5544 Underwood, Detroit, Mich.

New York

AUTOMATIC screw machine foreman. Can lay out cams for toolroom. Metropolitan New York only. PW-663, American Machinist, Tenth Ave. at 36th Street, New York.

DRAFTSMAN: American, age 45. Practical machine designer of wide experience. Complete designing, detailing, high-class, medium and small machinery. Capable of supervising development and building of same. Reasonable. New York vicinity. PW-742, American Machinist, Tenth Ave. at 36th St., New York.

EXECUTIVE of superior type; capable mechanical engineer, master mechanic and skilled inventor; 28 years in machine industry; expert in design, development and production of automatic and labor-saving machinery; 8 years chief engineer and factory manager. PW-700, American Machinist, Tenth Ave. at 36th St., New York.

POSITION WANTED

EXECUTIVE

of broad experience in foundry and general manufacturing in metal working field; general and financial management experience; excellent business and financial contacts in principal manufacturing centers; desires executive connection, where modernization of plant, new outlets for products or refinancing are required.

PW-753, American Machinist
Tenth Ave. at 36th St., New York City

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SCHOOL OF SCIENCE & TECHNOLOGY

Evening Classes

Mechanical Drawing, Machine Design, Structural Drafting, Structural Design, Strength of Materials, and other courses for draftsmen and designers.

Write for Circular or Call Monday, Tuesday or Thursday evening, except Dec. 26 to Jan. 2, inclusive, Pratt Institute, Grand Ave., near DeKalb Ave., Brooklyn.

POSITIONS WANTED

MACHINE shop superintendent or foreman, Christian, Masonic, American, 33. Experienced in research and development of precision, special automatic, electrical machinery, cam cutting, design, modern shop practice, gas-engines. Electrical and technical knowledge. Highest references, sobriety, reliability and character. Vicinity of New York City preferred. Seeks immediate connection. PW-755, American Machinist, Tenth Ave. at 36th St., New York.

MECHANICAL draftsman. Technical training. 10 years' drafting experience. PW-756, American Machinist, Tenth Ave. at 36th St., New York.

Ohio

SUPERINTENDENT, works manager or master mechanic, technical and practical experience covering 25 years of shop, designing and engineering supervision, on steam engines and heavy machinery. American, forty, desires location with a company that recognizes ability, energy and efficiency. PW-748, American Machinist, 7 So. Dearborn St., Chicago, Ill.

SALESMEN WANTED

New York, New Jersey and Pennsylvania

Calling on the automotive and mill supply trade in New York, New Jersey and Pennsylvania, to represent a new type reamer that is a marvel and bound to be a fast seller. We want only representatives who are well established with the trade. Write giving particulars. SW-758, American Machinist, Tenth Ave. at 36th St., New York.

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Ex-examiner U. S. Patent Office
Attorney-at-Law and Solicitor of Patents
McGill Building, Washington, D. C.
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CHARLES H. LOGUE

Mem. Am. Soc. M. E.
CONSULTING ENGINEER

Specializing in the Design and Manufacture of Gears.

123 Clark St., Syracuse, N. Y.

TO buy your machine tools from this list, means many dollars saved. And a dollar saved is a dollar earned, you know.

HIGH GRADE * READY TO PRODUCE * GUARANTEED

Lathes

1—56-64"x18' Johnson.
1—45"x24' Pond.
3—40"x12' Fifield.
1—36"x42' Gisholt Gun Borer.
2—36"x52' LeBlond, M.D.
3—36"x37' N.-B.-P.. M.D.
1—36"x30' Pittsburgh, G.H.
1—36"x24' Pittsburgh, G.H.
1—36"x20' Pittsburgh, G.H.
1—32"x12' Pittsburgh.
1—30"x12' L. & S. Sel. Hd.
2—30"x11' H. S. & G.
2—26"x18' Bridgeford.
5—26"x16' N.-B.-P.
2—26"x16' Whit.-Blaisdell.
10—26"x16' Bridgeford.
5—26"x14' Bridgeford.
5—26"x14' N.-B.-P.
1—26"x13' Wickes.
3—26"x12' Putnam.
5—26"x12' Bridgeford.
13—26"x11' Wickes.
30—26"x10' N.-B.-P.
21—26"x10' Canada.
15—26"x10' Whit.-Blaisdell.
44—26"x10' Bridgeford.
61—26"x 9' Bridgeford.
16—26"x 8' Bridgeford.
12—25"x12' LeBlond.
3—25"x10' LeBlond.
20—25"x10' Sidney.
1—24"x20' Reed-Pren., G.H.
1—24"x10' American.
9—24"x10' Cisco.
10—21"x10' LeBlond.
5—20-22"x16' American.
5—20-22"x12' American.
1—20"x10' Hamilton, M.D.
3—20-22"x8' American, M.D.
30—20-22"x8' American.
1—20"x 8' LeBlond.
1—18"x 8' Hamilton, M.D.
1—17"x8' LeBlond.
1—16"x14' American, G.H.
1—16"x14' Reed-Pren., G.H.
1—16"x 8' Monarch.
1—16"x 6' Sidney.
2—14"x 8' Pratt & Whitney.
1—14"x 8' Carroll-Jamieson.
1—14"x 6' American.
8—8" Fitchburg Loswing.
9—3½" Fitchburg Loswing.

Gear Cutters and Hobbers

2—No. 12 Barber-Colman.
1—No. 18-H Gould & Eberhardt.
1—No. 13 Brown & Sharpe.
1—No. 62 Fellows.
8—No. 6 Fellows.
1—No. 5 Lees-Bradner.
1—No. 3 36" Brown & Sharpe.

Drill Presses

1—No. 30 Natco.
2—No. 14 Natco.
1—No. 17 4-spdl. Foote-Burt.
1—No. 2 4-spdl. Colburn.
1—24"-2 spdl. Barnes, S. O.
1—No. 41 Natco.
1—No. 6 3-spdl. Moline Hole Hog.
1—No. 24 Foote-Burt.
1—No. 513 Baker.
2—No. 14 Colburn.
1—28" Rockford.
1—28" Cincinnati-Bickford.

Vertical Boring Mills

1—12' Betts.
4—72" Gisholt.
1—42" King.
1—36" Bullard, New Era.
1—30" Gisholt.

ReMANUFACTURED -(ORIGINATED BY US)- MACHINE TOOLS

Reg. U. S. Pat. Off.

Shaper

1—32" Cincinnati.

Auto. Screw Machines

3—No. 6-A Potter & Johnston.
4—No. 5-A Potter & Johnston.
1—No. 2-P Potter & Johnston.
1—⅝-⅞" Cleveland.
1—1⅝" 4-spdl. Gridley.

Horizontal Boring Machines

TABLE TYPE

1—No. 3-A Universal.
1—2-spdl. Espen-Lucas Boring, Milling and Drilling Machine.

Grinders—Continued

2—No. 20 Bryant Internal.
1—No. 2 18" Gardner Disc.
1—No. 6 18" Besly Ring Wheel.
1—No. 6 26" Gardner Disc.
1—Woods Tool & Cutter.

Radial Drills

1—5' Western Heavy.
1—3' American Sensitive.

Turret Lathes

1—26" Libby.
9—25"x10' LeBlond Univ.
26—24" Davis.
2—24" Steinle.
1—24" Gisholt.

Our Guarantee

Your money back, if you return a machine within thirty days, freight prepaid. No excuses necessary.

1—No. 3 Beaman & Smith Engine Frame and Cylinder Borer.
1—Beaman & Smith Cylinder Boring and Milling Machine.
5—No. 1 Barrett.
5—Rockford.

Grinders

1—24x96" Norton.
1—18x96" Norton.
3—14x72" Norton.
2—14x50" Norton.
1—12x120" Landis.
2—12x36" Modern.
3—12x36" Fitchburg.
3—10x72" Norton.
1—10x52" Landis.
1—10x50" Norton.
4—10x36" Norton.
2—10x24" Norton.
3—6x32" Norton.
1—No. 11 Brown & Sharpe.
1—No. 12 Brown & Sharpe.
2—22" P. & W. Surf.
1—12x36" Cincinnati Univ.
1—No. 2 Universal.
2—No. 70 Heald Internal.
1—10-A Bryant Internal.

2—21" Gisholt.
26—21"x10' LeBlond Univ.
3—20"x8' American.
25—19"x8' LeBlond.
24—19"x8' LeBlond Univ.
2—18" Libby.
2—No. 4 Warner & Swasey Univ.
1—3x36" Acme flat turret.
1—3x36" Jones & Lamson.
1—No. 1-B Foster Univ.
2—2 spdl. Jones & Lamson.
4—16" Cincinnati-Acme-Fox.

Hand Screw Machines

1—No. 10 3" Bardons & Oliver.
3—No. 8 Warner & Swasey.
2—No. 6 2½" Warner & Swasey.
1—No. 4 1½" Warner & Swasey.
1—No. 4 1½" Bardons & Oliver.
7—No. 3 1-5/16" Foster.
1—No. 3 1¼" Bardons & Oliver.
3—No. 2 1" Warner & Swasey.

Write for photo prints, descriptions and prices

HILL, CLARKE & CO. OF CHICAGO

651 W. Washington Boulevard, Chicago

Cable Address: REMAND Phone: Haymarket 7660

1—No. 2 1 1/16" Foster.
1—1x15" Pratt & Whitney.
5—No. 2 ⅝" Pratt & Whitney

Milling Machines

1—No. 3B Milwaukee, S.P.D.
1—No. 3 Kempsmith.
2—2B Milwaukee, S.P.D.
1—No. 2 Kempsmith.
2—No. 24 Oesterlein.
1—No. 25 Becker.
2—No. 3 Kempsmith Univ.
1—No. 2-A Brown & Sharpe Univ.
2—No. 1½ Garvin Duplex.
21—No. 3 Garvin.
16—No. 1 Van Norman, Hand.
31—No. 0 Bristol.
1—Pratt & Whitney, Cam.
1—Type B Briggs.
1—12" P. & W. Auto.
1—18" Cincinnati, Auto.
7—Putnam Semi-Auto.
175—P. & W. Hendey, Becker and Garvin Lincoln Millers.

Thread Millers

7—No. 3-E Lees-Bradner.
2—No. 3 Lees-Bradner.
1—Holden-Morgan.
3—HM Foster.

Slab Milling Machines

1—32x32"x12' Ingersoll.
1—24x13"x20' Ingersoll.
1—24x24"x8' Ingersoll.
6—24x24"x12' Ingersoll.
1—No. 3 92x54"x15' Beaman & Smith Milling and Boring Machine, Planer Type.
1—Beaman & Smith Open Side.
1—3-spdl. Beaman & Smith.

Vertical Millers

2—Model ACS 2-spld. Becker.
2—Model SD Becker.
1—No. 6 Becker.
1—No. 5-C Becker.
2—No. 5-B Becker.
1—Model CS Becker.
1—Model B Becker.
3—No. 3 Brown & Sharpe.
1—No. 3-B Milwaukee.
1—No. 2 Becker.
1—No. 2-A Becker.
1—Model AB Becker.
1—No. 2-B Milwaukee.
1—No. 1 Becker.

Planers

1—60x48"x30" Hamilton.
1—42x42"x22' D. & H.
1—42x42"x9' Niles-Bement-Pond.
3—36x36"x18' Cincinnati.
1—36x36"x12' Woodward & Powell, 2 Heads.
1—36x30"x20' Whit.-Blaisdell.
1—36x30"x18' Whit.-Blaisdell.
1—36x36"x12' Gray.
1—30x30"x14' Niles-Bement-Pond.
1—30x30"x8' Niles-Bement-Pond.
1—30x30"x8' Cincinnati.

Miscellaneous

1—6" Newton Slotter.
18—Pilton Slotters.
3—No. 4 LaPointe.
1—No. 4 J. N. LaPointe.
1—2-spindle Hoefer Cylin. Borer.

Send for a list of Our Enormous Stock

1—BULLARD 24-in. New Era Type.
1—VAN NORMAN No. 3 Duplex Miller with dividing heads, sub-heads, slotting attachment, collets.
1—BRIDGEFORD 42-in.x38-ft., geared hd., double carriage.

BORING MILLS

1—Bullard 24-in. N. E.
1—Baush 42-in. ver. 2-head.
1—Niles 42-in. ver. 2-head.
1—Putnam 44-in. ver. 2-head.
1—Colburn 54-in. ver. 2-head.
1—Rockford No. 2 horiz.
1—Bement-Niles horiz.
1—Cleveland 2½-in. bar Horiz.

AUTOMATIC SCREW MACHINES

12—B. & S. Nos. 0, 2, 2G auto.
10—Gridley 4-spdle. 9/16-in. ⅝-in., 1¼-in., 1⅝-in., 2¼-in.
10—Gridley 3¼-in., 4¼-in. single spdle.
13—Cleveland ⅝-in., ⅞-in., ¾-in., 7⅞-in. "A".
4—Cleveland ⅝-in., ⅞-in., ½-in., 1¼-in. "B".
1—New Britain, 1⅝x7 bar.
15—New Britain Nos. 23, 24, 33, 53, 54.
2—Natl. Acme No. 52; 54.
11—P. & J. No. 3-A; No. 6-A.

DRILLS
Multiple Spindle

3—Baush No. 2; No. 3; No. 4.
6—Natco Nos. 11, 13, 14, 40, rect. hd.
7—P. & W. No. 11, 12, 13.
1—Moline No. 5-D 6 spdle.
1—Foote Burt No. 25.
3—New Garvin 6-spindle.

DRILLS
Upright and Radial

2—Allen 4-spindle H.S. B.B.
2—Colburn Nos. 2 and 4.
1—Barnes 4-spdl. Gang. 20-in.
10—Barnes 15-in., 20-in., 22-in.
1—P. & W. No. 1 gun barrel.
1—New No. 3 Turner ver.
3—Baker No. 310.
2—Cin. Bickford 24-in.
1—Niles 5-ft. semi-univ. radial.
1—Baush 6-ft. Radial.
1—NPB 96-in. plain radial.

PLANERS

2—Putnam 26x26x8 ft. 2 heads.
1—Gray 38x38x28 ft. 3 heads.
1—Putnam 48x48x12 ft. 2 heads.

TURRET and SCREW MACHINES

9—Gisholt 24-in., 6¼-in. hole.
11—New P. & W. 7/16, ⅝-in.
1—Milwaukee No. 2-B Univ.
4—Greenlee 2¼x26.
4—J. & L. 2x24; 3x36.
1—Foster No. 1B.
2—Libby 26-in.; 4½-in. and 7¼-in. hole.
2—W. & S. No. 4.
6—Foster No. 4; 6.
1—Acme Fox Monitor.
1—W. & S. No. 0 B.G. P.F.
2—Gisholt simplimatics.

MILLING MACHINES

1—Cincinnati No. 3 Universal.
2—Cincinnati No. 4, No. 5 Pl.
1—Milwaukee No. 2-B Univ.
5—B. & S. No. 2, 4, 13-B pl.
1—Hendey Norton No. 3 pl.
1—Kempsmith No. 2 pl.
1—Becker No. 7 duplex.
1—Van Norman No. 3 Duplex.
11—Becker Nos. 3H, 4B, AB, 5C, C1 ver.
2—Cin. No. 4 ver.
9—P. & W. 4½x12; 6x14; 6x48; 6x80 thread.
15—P. & W. 5-in. auto.
24—P. & W. 4-in. spline.

BOLT CUTTERS

3—Acme ½-in. 2-spdle.
3—National 1½-in., 2-spindle.
1—Acme 2-in. double head.
1—Acme 4-in. single head.

SHAPERS and SLOTTERS

1—Cincinnati 20-in.
2—Stockbridge 20-in.
1—Colombia 28-in. shaper.
1—Queen City 16-in. shaper.
1—Rhodes 7-in. ver. shaper.
4—Dill 15-18-in. slotters.

PRESSES

5—Bliss No. 52.
1—Bliss No. 3¾ B Toggle.
2—Bliss No. 67-N double action.
1—Toledo rack and pinion.
25—Waterbury Farrel dble connection 2-in. and 4-in. stroke.
2—E. & H. No. 8½ percussion.

GEAR CUTTERS

5—Barber Colman Nos. 3 and 12.
7—B. & S. 3x36x26; 4x36.
6—G. & E. No. 18-H.
20—Fellows No. 6, 61, 615.
11—Gleason 6-in., 11-in., 18-in.
1—Gleason 15-in. spiral bevel finisher.
3—Fellows gear grinders.
10—Cross Gear Tooth Rounders.

LATHES

13—Hendey 12-in.x5-ft.; 12-in.x6-ft.; 14-in.x6-ft.; 16-in.x6-ft.
4—Seneca Falls 12-in.x6-ft. QCG.
3—Davis 12-in.x6-ft. QCG M.D.
10—South Bend 15x8; 18x8 gap.
1—Lodge & Shipley 16-in.x8-ft. Cone.
1—American 18-in.x10-ft. Cone.
1—Bradford 16-in.x12-ft.
1—Fay & Scott 20-42-in. gap.
1—Whitcomb 24-in.x18-ft. DBG.
1—New Flather 24-in.x27-ft.; QGG.
1—Walcott 26-in.x10-ft.

1—Bridgeford 26-in.x12-ft. QCG.
1—Greaves Klusman 26x12-ft.
1—Johnson 30x12-ft. mo. dr.
1—Bridgeford 42-in.x38-ft. grd. hd.
2—LeBlond 26x10 dup. crank.
2—Loswing 3½x84, 2 carr.
3—Porter Cable.
40—New Star—all sizes.

GRINDERS

4—B. & S. No. 10, 11, 12 pl.
4—Cin. No. 2, 12x36 pl.
7—Landis 6x18; 10x20; 10x24; 10x36; 12x36 pl.
8—Norton 6x32; 10x36; 16x36; 18x96 pl.
1—Queen City 16x72 pl.
1—Landis 10x52 cam.
1—Cin. No. 2 univ.
2—B. & S. Nos. 1 and 12 univ.
3—Thompson Univ.
1—P & W 14-in. BB Surface.
1—Landis 16x48 crank.
11—Bryant No. 6, 20 chuck.
2—Bryant No. 15 dbl. spdle.
12—Heald No. 65, 60, 70.
1—Rivett No. 205 radial.
1—Van Norman No. 34.

MISCELLANEOUS

LaPointe broaches, (Hudson and New London), 1, 2, 3 and 4.
1—Laidlaw, Dunn & Gordon 17x16 air compressor.
3—Clayton air compressors.
1—B. & S. 800 lb. drop ham.
1—Toledo 1500 lb. bd. drop.
1—New 30-lb. Bradley helve.
1—Bradley 80-lb. cushion helve.
1—Cox 3-lb. pipe mach.
1—Oster 3-in. No. 306 pipe.
1—Bignall & Keeler No. 12 duplex.
1—Newton 42-in. cold saw.
1—Espen Lucas 48-in. cold saw.
1—Newton 62-in. cold saw.
1—P & W No. 1 Die Sinker.
1—Jackson No. 8 Die Sinker.
1—P. & W. No. 4 duplex die sinker.
1—Keller E-3 engraver.
1—Wickes single end punch.
1—Etna No. 5-A swage.
1—N-B-P 10-ft. plate roll.
1—OHL 10-ft. power box brake.
2—P. & W. No. 12, 2-spdle, profilers.
2—Nilson No. 1, 4-slide, and No. 2, 3-slide Wire Formers.
1—Manville No. 4, 4-slide Wire Former
1—Langston 48-in. Slitter.
1—Utica 32-in. Slitter.
1—Bliss No. 225, 36-in. Slitter.

For complete list of machines write for our 32-page catalog!

MOREY AND COMPANY, Inc.
410 Broome St., New York
Telephone: Canal 5360

BUY IT FROM BOTWINIK—*where the value received is beyond the value expected, for the price you pay!*

SHAPERS—PLANERS—SLOTTERS

12-in. American, Motor Driven.
14-in. Steptoe, Cone Drive.
15-in. Kelley, Cone Drive.
15-in. Potter & Johnston, Motor Driven.
16-in. Steptoe, Cone Drive.
16-in. Gould & Eberhardt, Cone Drive
16-in. Cincinnati, Cone Drive.
20-in. Stockbridge, Motor Driven.
20-in. Ohio, Cone Drive.
24-in. Potter & Johnston, Cone Drive.
24-in. Gould & Eberhardt, Cone Drive.
24x24-in.x6-ft. Gray Planer, Sgl. Head.
30x30-in.x14-ft. Pond Planer, 2 Heads.
36x36-in.x12-ft. Chandler Planer, 2 Heads.
38x38-in.x10-ft. Niles, Sgl. Head.
51x48-in.x14-ft. Woodward & Powell, 2 Heads.
3-in. stroke Pilton Slotters.
3½-in. stroke Garvin Die Slotter.
10-in. stroke Niles Crank Slotter.

MILLING MACHINES

Ingersoll 20-in.x6 Slab, Open Side.
Pratt & Whitney 5-in. Automatic.
Cincinnati 28-in. Semi-Automatic.
Pratt & Whitney 2-in. and 4-in. Spine.
Whitney, Van Norman, Bristol Hand Millers.
Kempsmith No. 32 Lincoln Type.
Brown & Sharpe No. 1 Plain.
Rockford No. 1½ Plain.
Cincinnati, No. 3 Plain.
Brown & Sharpe No. 4 Plain.
Brown & Sharpe No. 12 Mfg. Type.
Cincinnati 12-in. Mfg. Type.
Pratt & Whitney 4½x12-in. Thread.
LeBlond No. 2 Universal.
Kempsmith No. 2 Universal.
Hendey No. 2 Universal.
Brown & Sharpe No. 2 Vertical.
Becker Model C. Vertical.

DRILLS

Pratt & Whitney No. 12 Adj. Multi-Spdl. 12 spdl.
Natco Type M4 Multiple Spindle, 22 spindle.
Bausch No. 4 Multiple Spindle, 12 spindle.
Hammond 4-ft. Sensitive Radial, Ball Bearing.
Prentice 5-ft. Plain Radial.
American 3-ft. Hi-Speed Sensitive Radial.
Baker 24-in. Hi-Duty Upright.
Cincinnati-Bickford 32-in. Upright, Tapping Attch.
Snyder 36-in. Upright, Tapping Attachment.
Allen 1-spindle Sensitive Ball Bearing.
Kokomo 1-spdl. Sensitive Ball Bearings, No. 161.
Allen 3-spindle Sensitive Ball Bearing.
Henry & Wright 3-spdl. Sensitive, Class K.
Turner Machine Co. 4-spdl. Model F Turret Drill.
Henry & Wright 8-spdl. Sensitive, Class K.

GRINDERS

Van Norman No. 24 Automatic Bore.
Ball & Roller Bearing Co. No. 14 Centerless Grdr.
Union Twist Drill Co., No. 3 Circular.
Landis 16x42-in. Crank Pin Grinder.
Pratt & Whitney Spline Mlg. Mach. Cut. Grdrs.
Heald No. 60 Cylinder.
Townsend 18-in. Disc.
Heald No. 70 Internal.
Norton 6x32-in. Plain Cylindrical.
Norton 3x18-in. Plain Cylindrical.
B. & S. No. 16 10x72-in. Plain Cylindrical.
Morse No. 1 4x20-in. Plain Cylindrical.
Brown & Sharpe No. 10 No. 11 Plain Cylindrical.
Norton 14x36-in. Plain Cylindrical.
Heald 16-in. Rotary Surface.
Pratt & Whitney Contour Cutter Grinders.
Union Twist Drill Co., No. 2 Formed Cut. Grdrs.
Brown & Sharpe No. 1 10x24-in. Universal.
Landis No. 3 12x42-in. Universal.
Pratt & Whitney 12-in. Vertical Surface.

LATHES

9x14-in. Porter-Cable Mfg Type.
No. 5½ 7x34-in. Sloan & Chace Bench Precision.
7x32-in. Pratt & Whitney Bench Precision.
12-in.x5-ft. 12-in.x6-ft. Hendey tl. rm. tap. att.
14-in.x5-ft. 14-in.x6-ft. Hendey tl. rm. tap. att.
16-in.x6-ft. 16-in.x8-ft. Hendey tl. rm. tap. att.
14-in.x6-ft. LeBlond, Q.C.G.
14-in.x6-ft. Lodge & Shipley, G.C.G.
14-in.x6-ft. Monarch, Q.C.G.
16-in.x6-ft. American, Q.C.G.
16-in.x6-ft. Simplex Gap—24-in. swing thru gap.
16-in.x6-ft. Cisco, Q.C.G.
18-in.x8-ft. Lodge & Shipley, Q.C.G.
20-in.x32-ft. New Haven Lead Screw Lathe.
30-in.x12-ft. American, Q.C.G.
32-in.x23-ft. Niles, D.B.G.
3½-in. Fitchburg Lo-Swing.
1x15-in. Pratt & Whitney Turret Lathes.
1½x18-in. Pratt & Whitney Turret Lathes.
2¼x26-in. Greenlee Flat Turrets, Cone Head.
3¼x36-in. Acme Flat Turrets.
No. 2A No. 3A Warner & Swasey Turrets, serial 178387.
20-in.x8-ft. American Q.C.G., Relieving Attach., Taper.

SCREW MACHINES

Garvin No. 22½ Duplex.
Potter & Johnston No. 5A Automatic Chucking.
Potter & Johnston No. 6A Automatic Chucking.
Brown & Sharpe Nos. 0, 00, OG, 2 Automatics.
National Acme Nos. 52, 56, 515 4-spdl. Auto.
Gridley 2½-in. Sgle. Spdl. and 4-spdl. Auto.
Gridley 3¼-in. Single Spindle Automatic.
New Britain No. 24 4-spindle Automatic.
Cleveland ½-in., ⅝-in., ⅞-in., 2¼-in., 2¾-in., 3¼-in., 4¼-in. Single Spdl. Automatics.
New Britain 1x5-in. 6-spdl. Automatic.
New Britain 1⅝x7-in. 6-spindle Automatic.
Bardons & Oliver, Foster, Garvin, Pratt & Whitney, Warner & Swasey, Brown & Sharpe Hand Screw Machines.

MISCELLANEOUS

Laidlaw, Dunn & Gordon 10x12-in. Belt Driven Air Compressor.
Bullard 42-in. Vertical Boring Mill.
J. N. LaPointe No. 1, No. 2, No. 3, No. 4, Broaching Machines, Single & Double.
Pratt & Whitney No. 1 Centering Machines.
Pratt & Whitney No. 2 Die Sinkers.
Gilbert & Barker No. A-4 Gas Furnace.
Fellows 36-in. Gear Shapers.
Chamberaburg & Bliss 600-lb. Board Dp. Hammer.
Noble & Westbrook Marking Machines.
New Haven Large Sand Blast Outfit.
Perkins No. 5½ Double Action Power Presses.
Bliss No. 1½ Strt. Side Toggle Drawing Press.
Bliss No. 68 Double Action Cam Press.
Pratt & Whitney No. 14 Profilers.
Townsend No. 1 No. 2 Riveters.
Waterbury Farrel Foundry 3½-in. cap. Alli. Shr.
Manville No. 2 Screw Slotters.
Corey No. 3 Shaft Straightener.
Langelier, Dayton, Standard Swaging Machines.
Garvin Tappers.

BOTWINIK BROTHERS, Inc.

67 Water St., New Haven, Conn. *"Connecticut Machinery Merchants"* **28 Drouve St., Bridgeport, Conn.**

DRILLS

2—7-ft. Western Heavy Duty.
1—6-ft. Niles-Bement-Pond Univ.
1—6-ft. Bickford Universal Radial.
1—5-ft. American Triple Geared.
2—5-ft. Western Heavy Duty.
1—5-ft. Breses Plain Radial Drill.
1—5-ft. N.-B.-P. Semi-Universal.
1—4-ft. Breses Plain Radial Drill.
1—4-ft. American Plain.
2—3-ft. Mueller Plain.
1—3-ft. Western Plain.
1—3-ft. American Plain.
1—2-ft. American Plain.
1—No. 2 Foote-Burt Drill.
1—No. 32 Nateo Multiple Spindle.
1—No. 14 Nateo Multiple Spindle.
6—No. 13 Pratt-Whitney Mult. Spd.
1—No. 2 Baush Multiple Spindle.
1—No. 3 Baush Multiple Spindle.
1—No. 4 Baush Multiple Spindle Drill.
1—No. 1 Pratt-Whitney Deep Hole Driller.
3—12-in. Cin.-Bickford S.H. Drills.
2—32-in. Aurora S.H. Drills.
2—26-in. Barnes All Geared Drills.
3—24-in. Cincinnati Sliding Head.
3—20-in. Barnes All Geared.
5—Four Spindle Henry-Wright B.B.
1—3-spindle Allen Ball Bearing.
1—3-spindle Henry-Wright Ball Bearing.
8—Edlund High Speed B.B.
3—2-spindle Edlund B.B.
3—24-in. Cincinnati S.H. Tapping.
1—No. 1-S Garvin Duplex.

AUTOMATICS

2—No. 2G Brown-Sharpe.
2—No. 0 Brown-Sharpe.
47—¾-in. Gridley four spindle.
10—1¼-in. Gridley four spindle.
10—1¾-in. Gridley four spindle.
3—1¼-in. Cone, 4-spindle.
10—2¼-in. Gridley, 4 Spdl.
9—2¼-in. Gridley Single Spdl.
2—3¼-in. Gridley Single Spdl.
4—4¼-in. Gridley Single Spdl.
1—No. 6-A Potter & Johnston.

BORING MILLS

1—24-in. Bullard New Era.
1—36-in. Bullard Rapid Production.
1—42-in. Bullard Two Swivel Heads.

SPECIALS
47—3-4" GRIDLEYS
10—1 1-4" GRIDLEYS
10—1 3-4" GRIDLEYS
10—2 1-4" GRIDLEYS
FOUR SPINDLE AUTO-MATICS

1—No. 4-B Milwaukee Vertical.
1—No. 5 Brown-Sharpe Vertical.
1—No. 2 Cincinnati High Power Plain.
3—No. 2-B Milwaukee Plain.
3—No. 3-B Milwaukee Plain.
3—No. 3-B Hendey Plain.
1—No. 4-G Hendey Plain.
1—No. 4 Cincinnati Plain.

1—30x14 Lodge-Shipley cone drive.
1—30x20 Pond Triple Geared.
1—36x29 American Geared Hd.
1—36x70 American Geared Head.
2—36x20 American Geared Head.
1—36x60 Bridgeford Boring.
1—42-in. N.-B.-P. Car Wheel.
1—42x50 Putnam Geared Head.
1—42x50 American Geared Head.
8—42x39 Putnam Geared Head.
1—44x34 Pond Triple Geared.
1—48x36 Pittsburgh Motor Drive.
1—48x21 Niles-B.-Pond Late Type.
1—50x25 Putnam Motor Drive.
2—50x36 Pittsburgh Geared Head.
2—54x34 Bement Triple Geared.
1—60x35 Bement Triple Geared.
1—72x56 N.-B.-P. Triple Gd.
1—84x30 Putnam motor drive.

SCREW MACHINES

1—26-in. Libby Turret Lathe.
5—18-in. Libby Turret Lathes.
3—No. 3-A Warner-Swasey Turrets.
1—No. 2-A Warner-Swasey.
1—No. 4 Warner-Swasey, Universal.
8—No. 4 Warner-Swasey Turrets.
1—No. 6 Warner-Swasey Turret.
1—1½x18 P & W Turret.
5—2x36 Pratt-Whitney Turrets.
1—34in.x24-ft. Gisholt Turret.
3—3x36 Jones & Lamson.
1—No. 4 Milholland 1⅝x10.

MISCELLANEOUS

1—2-in. Acme Bolt Cutter.
1—8-in. Bignall-Keeler Pipe Mch.
1—Imperial Type XB Air Comp.
1—No. 4 LaPointe Broach.
1—No. 3 LaPointe Broach.
1—No. 3 Pratt-Whitney Die Sinker.
5—6-in. Gleason Gear Generators.
9—18-in. Gleason Gear Generators.
8—5-A Lees-Bradner Gear Hobbers.
1—96-in. Pratt-Whitney Gear Cutter.

THESE SIMMONS "RESTORED" MACHINES

present the opportunity to buy what virtually amounts to new machine performance at a heavy saving in cash.

We have the men, the plant and the broad knowledge required to "Restore" the production by which original owners of the machines profited. That is why hundreds of plants bring their replacement problems to us.

1—54-in. Colburn Two Swivel Heads.
2—72-in. N-B-P Rapid Traverse.
1—84-in. Pond Extra Heavy, Two Heads.
1—96 Niles Heavy Vertical.
1—10-16-ft. Niles Vert. Exten. Mill.
1—7-in. Bar Newton Horizontal Mill.
1—No. 7 Barrett Horizontal, 8-in. bar.
1—No. 5 Barrett Horizontal, 6-in. bar.
1—No. 3 Barrett Cylinder.
1—No. 21 Lucas Horizontal.
1—No. 2 Rockford Horizontal.
1—No. 2 Rochester Horizontal.
1—No. 0 Giddings & Lewis Horizontal.
1—No. 0 Niles Horizontal.

GRINDERS

1—10x52-in. Landis Camshaft Gr.
1—14x96 Norton Cylindrical.
3—14x50-in. Norton Cylindrical.
2—16x52 Landis Plain.
6—6x32 Norto nCylindrical.
1—14-in. Pratt-Whitney Vertical.
1—30x84 Diamond Face.
1—No. 615 Fitchburg Plain.
5—No. 70 Heald Internal.
5—No. 65 Heald Grinders.
5—No. 60 Heald Grinders.
1—No. 13 Brown-Sharpe Universal.
1—No. 3 Cincinnati Univ.
1—No. 2½ Bath Universal.
1—No. 2 Norton Universal.
1—No. 1 LeBlonde Univ.
1—Springfield Planer Type Surface Grinder.

MILLERS

1—No. 2 Cincinnati Vertical.
1—No. 3 Cincinnati Vertical.
1—No. 4 Cincinnati Vertical.
1—No. 4 Cincinnati, Intermittent Feed.

1—No. 5 Cincinnati Plain.
1—No. 1 Brown-Sharpe Universal.
1—No. 2-B Rockford Universal.
1—No. 3-B Milwaukee Universal.
1—No. 4 Lees-Bradner Thread.
1—No. 8 Lees-Bradner Thread.
2—24x24x6-ft. Ingersoll.
1—60x20x12-ft. Ingersoll, 3 hds.
4—5-in. Pratt-Whleny Automatics.
3—18-in. Cincinnati Automatics.
1—No. 3½ P & W Duplex.

PLANERS

1—72x72x18-ft. D. & H. Openside.
1—60x60x16-ft. D. & H. Openside.
1—48x48-in.x14-ft. Betts, 4 hds.
1—48x48x14-ft. N-B-P, 3 Hds.
1—48x48-in.x10-ft. Cincinati, 4 hds.
1—36x36x20-ft. Woodward-Powell.
1—36x36x12-ft. N.-B.-P. 4 hds.
1—36-in. Newton Rotary.
4—30x30x12-ft. N.-B.-P. 2 hds.
1—26x26x6-ft. Gray, Heavy Duty.
6—24x24x10-ft. Whitcomb-Blaisdell.
1—24x24x8-ft. Whitcomb-Blaisdell.
1—24x24x6-ft. Powell Hi Speed.

LATHES

5—10x5 Pratt-Whitney Tool Room.
3—14x6 Hendey Tool Room.
1—14x8 American, Heavy.
6—16x6 Hendey Tool Room.
2—16x8 Prentice G. Hd.
2—18x8 Greaves-Klusman G. Hd.
1—18x10 Monarch Cone Drive.
1—18-12 Monarch Cone Drive.
1—20x8 Hendey Tool Room.
1—20x42x6 Fay Scott Gap.
1—24x10 American Geared Hd.
1—25x12 LeBlond Heavy Duty.
1—26x22 Boye-Emmes Motor Drive.
2—30x12 American Geared Head.
1—30x60x12 McCabe 2 in 1.

2—24-in. Gleason Gear Planers.
1—36-in. Gleason Gear Planer.
2—No. 12 Barber-Colman Hobbers.
1—No. 4-B Nazel Air Hammer.
1—No. 5-B Nazel Air Hammer.
5—50-lb. Bradley Helve Hammers.
1—300-lb. Bradley Helve Hammer.
1—300 lb. Bradley Compact Hammer.
1—3,500-lb. Niles Steam Drop.
1—5-ton Wern Rotator.
50—20-in. Cincinnati Rotary Tables.
1—No. 2 BG Garvin Tapper.
1—¾-in. Ajax Steel Bed Upsetter.
1—1½-in. Ajax Upsetter.
1—2-in. Ajax Upsetter.
1—2½-in. Ajax Upsetter.
1—2½-in. Acme Upsetter
1—3½-in. Ajax Upsetter.
1—No. 77 Bliss Geared Press.
1—No. 74½ Bliss Press.
1—No. 55 DDG Ferracute Press.
1—No. 37½ Bliss Press.
1—No. 2 Sidney Inclinable.
1—No. P-3 Ferracute.
4—No. P-4 Ferracute.
1—No. 4 Niagara Inclinable.
1—26-in. N-B-P Traveling Head.
1—24-in. Cincinnati Shaper.
1—10-in. Pratt-Whitney Vertical Shaper.

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AUTOMATICS

5/16-in. No. 00 Brown & Sharpe (21).
⅜-in.-⅛-in. & 2¼-in.-3¾-in. Cleveland, Model A.
1¼-in. & 2¼-in. Gridley 4 spindle.
3¼-in. Gridley single spindle.
1-in.x5-in. New Britain 6 spindle.
1-in. New Britain "Sextuple."
2¾-in. National Acme 4 spindle.
No. 22 New Britain chucking.
14-in. Fay chucking.
No. 6A Potter & Johnston.
No. 2P Potter & Johnston piston and piston ring.
⅞-in. Cleveland automatic stud threader.

DRILLS, RADIAL

2½-ft. Cincinnati Bickford.
2½-ft. Canedy Otto—Cheap.
3-ft. Cincinnati Bickford.
3-ft. American Sensitive, T.A.
3½-ft. Morris.
3½-ft. American.
4-ft. Mueller.
4-ft., 5-ft., 6-ft. and 8-ft. Western.
6-ft. Dreses Heavy Duty.

DRILLS, MULTIPLE and MISCELLANEOUS

26 spindle type 3 Baush, 16-in.x36-in. head.
26 spindle type 2 Baush, 26-in. round head.
24 spindle type 3 Baush, 20-in.x40-in. head.
12 spindle No. 30 Natco, 26-in. round head.
12 spindle Gardam, 12-in.x12-in. head.
16 spindle Natco drill head, 12-in.x18-in. head.
6 spindle National Acme automatic.
5-spindle Detroit automatic drill.
2 spindle No. 15 Garvin horizontal.
4 and 8 spindle No. 11-D Moline hole-hogs.

GEAR CUTTERS

No. 3 Barber-Colman, hobbers (2).
12-in., 18-in. and 24-in. Gould & Eberhardt hobbers.
48-in.x10-in. Gould & Eberhardt, automatic spur.
36-in. and 48-in. Brown & Sharpe, automatic spur.
26-in. Cincinnati, automatic spur.
No. 13 Brown & Sharpe, automatic spur and bevel.
No. 61 Fellows gear shaper.
No. 13 Brown & Sharpe, automatic spur and bevel.
12-in. Ingle gear tooth rounder.
No. 1 Brown & Sharpe gear tester.
8-in. Gleason spur gear tester.

GRINDERS, CYLINDRICAL

6-in.x22-in. 10-in.x24-in., 14-in.x72-in. and 18-in.x96-in. Norton.
6-in.x18-in., 10-in.x20-in., 10-in.x35-in., and 12-in.x36-in. Landis.
8-in.x18-in. and 12-in.x24-in. Modern.
8-in.x26-in. Fitchburg Model A.
16-in.x30-in. No. 2 Webster & Perks Universal.
10-in.x48-in. Brown & Sharpe.

GRINDERS, SURFACE

Nos. 1 and 3 Wilmarth & Morman.
12-in.x12-in.x36-in. No. 2 Diamond.
14-in.x40-in. Pratt & Whitney vertical.
50-in.x22-in.x18-in. Safety Emery Wheel Co.

GRINDERS, TOOL and CUTTER

No. 1 Greenfield Universal.
No. 2 Norton Universal.
No. 3 Ohio Universal.
10-in.x36-in. Thompson Universal.
10-in.x36-in. No. 2½ Bath Universal.
2¼-in. cap'y. Wilmarth & Morman drill.
2½-in. Wilmarth & Morman drill, motor drive.
24-in. Ingersoll milling cutter.
Landis die chaser grinder.
Gisholt lathe and planer tool grinder.

GRINDERS, MISCELLANEOUS

84-in. Diamond Face and Edge.
16-in.x48 in. Landis Crankshaft.
No. 60 Heald Cylinder.
Nos. 70 and 75 Heald Internal.
20-in. Blount Wet Tool.
12-in. No. 3 Blount Emery Stand.
16-in. Model D Norton Grind Stand.
24-in. Diamond double end snagging.
No. 205 Rivett radial.
No. 2 Gardner automatic.
No. 14 Gardner double end opposed wheel.
24-in., 26-in., and 30-in. Gardner double disc.
53-in. Gardner No. 24 horizontal disc.

LATHES, MISCELLANEOUS

14-in.x10-ft. LeBlond Rapid Production.
17-in.x8-ft. LeBlond Mfg.
26-in.x10-ft. LeBlond Universal crankshaft.
21-in.x10-ft. LeBlond Crankshaft.
3½-in.x60-in. Fitchburg Lo-Swing.
11-in.x4-ft. Blount, speed.
10-in.x4-ft. plain turning.
24-in.x16-ft. Fay & Scott double end.
16-in. Reed Prentice production.

MILLS, BORING VERTICAL

34-in. Bullard, single turret head.
36-in. Niles.
42-in. Bullard.
53-in. Niles-Bement-Pond power rapid traverse.

MILLS, HORIZONTAL BORING

3½-in. bar No. 3⅛ Universal.
3-in. bar No. 1 Lucas.
3-in. bar No. 2A Universal.
3-in. bar Fosdick.
2½-in. bar No. 1 Cleveland.
Rockford with 3⅛-in. spindle.

PRESSES

Size B Rockford OBI 1-in. stroke.
No. 1 Consolidated OBI 1½-in. stroke.
No. 18 Bliss OBI.
No. 30 Long & Allstatter OBI 3½-in. stroke.
No. 4 Walsh OBI 2½-in. stroke.
No. 53 Toledo SS 6-in. stroke.
No. DDG54 Ferracute double action, cam drawing.
No. 65 Consolidated S. S., 5-in. stroke.
No. 66 Consolidated S. S., 5-in. stroke.
No. 68 Consolidated geared, 6-in. stroke.
No. 4 Massillon S. S. geared, 4-in. stroke.
No. 24 Stoll knee type (horning), 2-in. stroke.
No. 41 Toledo geared horning.

SHAPERS

6-in. Pratt & Whitney, vertical.
14-in. Davis.
15-in. Niles.
16-in. Columbia "Superior." NEW.
16-in. Cincinnati.
16-in. Smith & Mills, single pulley drive.
20-in. Queen City.
20-in. Walcott.
22-in. Gould & Eberhardt.
25-in. Springfield.
30-in. Walcott.

WOOD WORKING

16-in. Porter Jointer.
30-in. American Clement Jointer.
24-in. Herzog Jointer feeder.
32-in. Egan Band Saw.
36-in. American Band Saw.
American Self-Feed Rip Saw.
Crescent motor driven Swing Saw.
26-in.x7-in. American Clement Planer.
No. 3 Oliver Wood Trimmer.
Nos. 2 and 3 Reynolds Screw Driving Machines.
20-in.x10-ft. Porter Wood Lathe.
16-in. American Wood Lathe.
American Tenoner, Houston Pattern.
Hayes Double End Tenoner.
32-in.x12-in. Wickes No. 10 Gang Saw.

MILES
MACHINERY COMPANY
SAGINAW, W. S.
MICHIGAN

Boring Mill, 72 in. vertical.
Drills 20 in., 22 in., 24 in., 26 in. and 32 in.
Drills, Bench, Avey No. ½ and Leland-Gifford.
Grinders, Universal 12-in.x36-in., Cincinnati.
Grinders, Surface, W. & M. No. 1 and 78.
Hammers, 40-pound, Bradley Helve.
Hammers, No. 1 Pettingell.
Lathe, Monarch 14x6 and 16x6.
Lathe, American 18x10 quick change.
Lathes, 16-in.x8-ft. Monarch with collet and taper attachments.
Lathe, 24-in.x24-ft. Prentice, raising block.
Lathe, Turret No. 1 Foster.
Miller, Plain, No. 25 Becker.
Milling machine, B. & S. No. 2 heavy plain.
Milling Machine, No. 3 Cincinnati, Universal.
Presses, No. 2½ Toledo o.b.i.; No. 660 Embossing.
Presses, No. 3-A Willard & No. 1, 1½ & 2 Robinson.
Presses, Emco bench for radio parts.
Punch & Shear, ⅛x⅛ style L-10.
Shear, Peck, Stow & Wilcox, 18 gauge, 60-in.
Shear, 5 ft. for 10 gauge metal.
New 3 Phase Motors, 5 hp. $65.50; 3 hp. $54.50.

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Columbus, Ohio (1)

No. 3 **Kempsmith Plain Miller** with Vertical Attachment.
3—No. 4 **Warner & Swasey Friction Head Screw Machines,** power feed.
2, 3 and 4 Spindle **Allen B. B. Drills.**
1—96-in. **Squaring Shear.**

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1—26-in.x14-ft. Boye & Emmes.
4—26-in.x12-ft. Boye & Emmes.
1—20-in.x8-ft. Boye & Emmes.
1—20-in.x10-ft. Monarch. 1—18-in.x8-ft. S. B.
1—16-in.x8-ft. Monarch. 1—16-in.x7-ft. Chard.
1—14-in.x6-ft. Monarch. 1-12-in.x5-ft. Sidney.

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POND PLANER

96-in. x 48-in. x 12-ft, 2 rail heads, 2 side heads; table 88 in. wide, 6 in. thick; center to center of vees 52 in.; motor driven. Excellent condition. Can be inspected running.

$2200 f.o.b. cars Fort Wayne, Indiana

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Fort Wayne, Indiana

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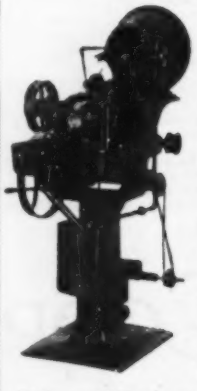

SCREW SLOTTERS

9 — E. J. Manville No. 2 Screw Slotters with Hopper Feeds, good condition, $300 each (like cut).

Size of Slot..... 5/16"
Dia. of Hopper at Largest End. 14"
Depth of Hopper. 11"
Drive Pulley Size .....16"x1¾"
Floor Space. 42"x28"

These machines were used for slotting the heads of ¼ in. screws.

BOTWINIK BROS., INC.
No. 67 Water St., New Haven, Conn.

1200 POWER PRESSES

ALL MAKES AND TYPES

BLISS, TOLEDO, Etc.

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2—300 hp., 4 cylinder, Bruce Macbeth, with all attachments. Speed 225 r.p.m. Can be seen running. Address

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G-9

QUALITY TOOLS—*not how cheap, but how good!*

LATHES

3—12x5-ft. Hendey T.A. and pan bed.
2—14x6-ft. Hendey T.A.
2—14x6-ft. LeBlond.
1—14x6-ft. American T.A.
3—14-in. Monarch T.A.
2—16-in. Monarch T.A.
1—16x7-ft. Hendey, relieving attachment, T.A. draw-in bar, collets, pan bed.
3—16x8-ft. Hendey T.A.
2—18x8-ft. Hendey T.A. draw-in and collets.
2—18x10-ft. Hendey T.A.
1—22-44-in. Harrington gap.
1—20x8-ft. Monarch.

MILLS

2—No. 1½ Brown & Sharpe universal.
2—No. 2 Brown & Sharpe universal.
2—No. 2 Hendey universal.
2—No. 2 Cincinnati universal.
1—No. 2½ LeBlond universal.
2—No. 2 Valley City universal.
2—No. 2 LeBlond universal.
1—No. 3 Cincinnati universal.
10—Plain mills.
6—Type A & B Gooley & Edlund mills.
1—No. 2 Van Norman.
1—36-in. Bullard vert. boring mill, side head.
4—Nos. 4-5-6 Becker vert.
7—Nos. 3-4 Cincinnati vert.
5—P&W spline mills.
2—Newton spline mills.
2—Hendey prod. mills.
2—Beaman & Smith prod. mills.
1—No. 2 Knight miller and driller.

SHAPERS

2—16-in. G&E cone.
3—20-in. G&E cone.
2—24-in. G&E arranged M.D.
2—24-in. G&E cone.
1—24-in. Smith & Mills cone.
1—24-in. Sterling, S.P.D.
1—24-in. Kelly M.D. with motor.
1—32-in. Morton draw-cut.

DRILLS

5—2 spd. H.D. Fosdick H.S.B.B.
1—4 spd. Allen H.S.B.B.
1—4 spd. H&W H.S.B.B.
1—4 spd. Avey H.S.B.B.
1—6 spd. Allen H.S.B.B.
1—Single spd. H&W H.S.B.B. 24-in.
1—Single spd. Kokomo H.S.B.B.
2—26-in. Barnes A.G. drills arranged M.D.
1—No. 20 Foote-Burt, H.D.
1—4 spd. Barnes 26-in. A.G.H.D.
1—No. 1 Bausch mult. spd. drill.
1—3½-ft. Cincinnati Bickford S.P.D.
1—4-ft. Mueller radial S. P. D.
1—3-ft. Bickford radial S. P. D.
1—3-ft. American sens. radial.
1—6-ft. Western H.D. S.P.D. Radial.
1—No. 2-No. 14 Colburn H.D. drills.
1—No. 65-D-5 Moline holehog.
1—Detroit semi. auto. driller.
1—National Acme semi. auto. driller.
4—26-in. W. F. & J. Barnes.

GRINDERS

3—No. 2 B&S surface.
2—No. 2 B&S universal.
1—No. 11 B&S plain.
2—No. 10 B&S plain.
3—No. 65 Heald cylinder.
2—No. 2 W&M surface.
1—No. 3 W&M surface.
1—No. 1 W&M tool & cutter.
1—14-in. P&W surface.
1—60-in. Reed Prentice vert. surface.
2—No. 1 LeBlond T&C.

TURRET AND AUTO LATHES

2—2A W&S.
4—2 spd. J&L.
3—6A-P&J.
4—Gisholt Simplimatics M.D.
2—No. 24 New Britains.
1—2¼-in. Gridley 4 spd.
3—No. 4 B&O.
2—No. 7 B&O.
16—No. 2-3-5-7 Fosters.
2—No. 20 Gisholt automatics.
3—No. 2 W&S.
2—No. 4 W&S F.H.
2—No. 6 W&S F.H.
3—Springfield Fox Monitors.

PRESSES

1—No. 93 B Toledo D.C.
1—No. 54 Toledo S.S.
1—No. 55 Toledo S.S.
1—No. 24 Michigan.
1—No. 409B Bliss toggle.
1—No. 68 Bliss D.A.
1—No. 355 Toledo rack and pinion press.
1—No. 857 Toledo rack and pinion press.
1—No. 83 and No. 84 Consolidated horn.
1—15 ton Lucas forcing.
2—Holmes screw feed presses.
1—Stecher screw press.
2—No. 20B Bliss O.B.I. presses.
1—No. 27 K. Bliss knuckle joint press.
1—No. 8C Bliss S.S. press.

MISCELLANEOUS

4—No. 1 Garvin Tappers.
3—No. 2 Garvin Tappers.
1—1,500 lb. Chambersburg Steam Hammer.
1—2,500 lb. Chambersburg Steam Hammer.
1—7,500 lb. Chambersburg Steam Hammer.
1—15 Ton Hercules vert. Broach.
1—8-in. Newton slotter.
1—24-in. Gray planer.
1—30-in. Wilson planer.
1—36-in. Niles planer.
6—Hurlbut & Rogers cutting-off.
4—Lees Simplex cold saws.
14—Air compressors.
1—2½-in. Landis bolt cutter.
1—Nos. 2-3-4 LaPointe broaches.
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2—2 bu. o.l separators.

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Alternating Current Motor Drive including 4-speed A.C. Motor, 60 cycle, 220 volt.

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No. 4-B Heavy Brown & Sharpe **Plain Miller,** M.D.
No. 3 G. H. LeBlond Heavy **Plain Miller,** SPD.
No. 2 Brown & Sharpe **Surface Grinders.**
No. 6 Brown & Sharpe Geared Friction Head **Screw Machines.**
No. 12 Brown & Sharpe **Plain Grinder** 8x36 SPD.
No. 11 Brown & Sharpe **Plain Grinder** 4x30.
12-in. Bement Miles **Slotter.**
No. 1 J. N. Lapointe **Broaching Machine.**
14-in.x8-ft. Hendey **Tool Room Lathe.**
16-in.x8-ft. Reed **Lathe** B&F.
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125 lbs. Dupont **Power Hammer.**

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1—No. 2 Stiles Pattern Power Press.
1—No. 5 Waterbury F.F. D.A. Cam Press.
1—Waterbury F.F. 20-ton Rack & Pinion Press.
1—250-lb. Standard Mach. Co., Pl. Drop.
1—No. 5 A. Miner & Peck 300-lb. Hammer Automatic Lift.
1—No. 1 W. Miner & Peck 300-lb. Hammer Automatic Lift.
1—1200-lb. Bliss Board Drop.
6—Taylor & Fenn Spring Foot Presses.
4—100-lb. Standard Automatic Drops.
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1—No. 0 Brown & Sharpe Plain Mill Mach.
1—18-in.x10-ft. Seneca Falls Q.C.G., C.R.
1—18-in. Prentice Chucking Lathe.
1—3x36-in. Jones & Lamson Turret Lathe, both Bar and Chuck Equipment.
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1—No. 3 Garvin Plain Milling Machine
1—Gooley & Edlund Milling Machine.

MISCELLANEOUS

1—24x24-in.x6-ft. Gray Planer.
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1—No. 14 Brown & Sharpe Plain Grinder.
1—Diamond Knife Grinder.
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1—Bilton Gear Cutting Machine.
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1—Waterbury Mach. Co., Inv. Bull Block.
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25-in.x10-ft. Crawford Lathe, Q.C.G.
22-in.x12-ft. Reed cone drive.
22-in.x8-ft. Davenport Lathe, H.P.
18-in.x8-ft. Hollingworth Lathe, Q.C.G.
18-in.x8-ft. Cisco, Geared Head, New.
16-in.x8-ft. Schumaker B & E Lathe, T.A
14-in.x8-ft. Carroll-Jamieson Lathes, New.
14-in.x6-ft. Carroll-Jamieson Lathes, New.
13-in.x21-in.x8-ft. Star Gap Lathe.
28-in. Gisholt Turret Lathe, Belt Driven.
42-in. Bullard Vertical Boring Mills.
37-in. Baush Vertical Boring Mill.

Millers and Grinders

No. 4 Cincinnati High Power Plain Miller.
No. 5 Becker Vertical Miller.
No. 3 Kempsmith Plain Miller.
No. 3 Becker Vertical Miller.
No. 2½ LeBlond Plain Miller.
No. 2 Kempsmith Plain Miller.
No. 2 Hendey-Norton Universal Miller.
No. 13 Garvin Plain Millers (2).
No. 32 Kempsmith Mfg. Type Miller.
4-in.x30-in. P. & W. Cylindrical Grinder.

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6 Spindle Gardam Multiple Drill.
No. 25 Foote-Burt Heavy Duty Drill.
24-in. Weigel Sliding Head Drill.

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24-in. Cincinnati Heavy Duty Shaper.
24-in.x24-in.x10-ft. Chandler Planer.

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200 lb. Beaudry Upright Power Hammer.
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40 lb. Bradley Helve Hammer.
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Beloit Combined Punch and Shear, cap. ⅝ x ⅝-in.

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No. 1 Davis Keyseater.
No. 3B LaPointe Broaching Machine.
12-in. Jarecki Pipe Machine 2½-in.-12-in.
9-in. and 6-in. Curtis & Curtis Pipe Machines

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Claremont and West Side Aves.,
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Norton Co., Worcester

Accumulators, Hydraulic
Watson-Stillman Co., N. Y.

Alloys, Special
Union Drawn Steel Co., Beaver Falls

Angle Plates
Boston (Mass.) Scale & Machine Co.

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Cincinnati (O.) Milling Mach. Co.
Cleveland (O.) Twist Drill Co.
Nicholson & Co., W. H., Wilkes-Barre
Sundstrand Mach. Tool Co., Rockford, Ill.
Union Mfg. Co., New Britain
Union Twist Drill Co., Athol, Mass.
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Whitney Mfg. Co., Hartford

Babbitt
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Gisholt Machine Co., Madison, Wis.

Balancing Ways
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Fafnir Bearing Co., New Britain
New Departure Mfg. Co., Bristol

Balls, Steel, Brass and Bronze
Abbott Ball Co., Hartford
Auburn Ball Bearing Co., Rochester
Hartford (Conn.) Steel Ball Co.
New Departure Mfg. Co., Bristol

Barrels, Burnishing & Tumbling
Abbott Ball Co., Hartford
Hartford (Conn.) Steel Ball Co.

Bars, Boring
Barrett Machine Tool Co., Inc., Meadville, Pa.
Cleveland (O.) Twist Drill Co.
Underwood Corp., H. B., Phila

Bars, Phosphor Bronze, Cored and Solid
Bunting Brass & Bronze Co., Toledo

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Ahlberg Bearing Co., Chicago
Auburn Ball Bearing Co., Rochester
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Torrington Co., Torrington

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Bunting Brass & Bronze Co., Toledo
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Michigan Smelt. & Refin. Co., Detroit

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Michigan Smelt. & Refin. Co., Detroit
Milwaukee Die Cast Co., Milwaukee
Stewart Die Casting Corp., Chicago

Bearings, Journal
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Timken Roller Bearing Co., Canton

Bearings, Thrust
Timken Roller Bearing Co., Canton

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Belt Lacing
Clipper Belt Lacer Co., Grand Rapids
Rhoads & Sons, J. E., Phila.

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Jones Fdry. & Machine Co., W. A., Chicago

Belting, Chain (See Chains, Driving)

Belting, Leather
Rhoads & Sons, J. E., Phila.

Bench Legs
Brown & Sharpe Mfg. Co., Providence

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Elmes Eng. Wks., Chas. F., Chicago

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Automatic Mach. Co., Bridgeport

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Cons. Mach. Tool Corp., Rochester
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Manning, Maxwell & Moore, N. Y.
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Universal Boring Mach. Co., Hudson.

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Knight Mchy. Co., W. B., St. Louis
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Shaw Crane-Putnam Machine Co., N. Y.

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Casler, Herman, Canastota, N. Y.
Waterston, J. M., Detroit

Boring Tools
Armstrong Bros. Tool Co., Chicago
Madison Mfg. Co., Muskegon

Boxes, Tote (See Furniture, Machine Shop)

Brakes, Electric Magnetic
Cutler-Hammer Mfg. Co., Milwaukee

Brackets, Lamp Adjustable
McCrosky Tool Corp., Meadville, Pa.

Broaches
Lapointe Co., J. N., New London
LaPointe Mach. Tool Co., Hudson.

Broaching Machines
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Lapointe Mach. Tool Co., Hudson

Bronze
Bunting Brass & Bronze Co., Toledo
Phosphor Bronze Smelting Co., Philadelphia

Bronze, Phosphor
Bunting Brass & Bronze Co., Toledo
Phosphor Bronze Smelting Co., Phila.

Bucket Carriers, Pivoted
Link-Belt Co., Chicago

Buffing or Polishing Machines (See Polishing and Buffing Machines)
Link-Belt Co., Chicago

Burners, Oil and Gas
Johnson Gas Appliance Co., Cedar Rapids, Iowa

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Acme Industrial Co., Chicago
Bunting Brass & Bronze Co., Toledo
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Bushings, Drill and Jig
Acme Industrial Co., Chicago
Ex-Cell-O Tool & Mfg. Co., Detroit

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Cable, Insulated
Simplex Wire & Cable Co., Boston

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Brown & Sharpe Mfg. Co., Providence
Slocomb Co., J. T., Providence
Starrett Co., L. S., Athol, Mass.

Cam Cutting Machines
Rowbottom Machine Co., Waterbury

Cams
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American Gas Furnace Co., Elizabeth

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Meisel Press Mfg. Co., Boston
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Bunting Brass & Bronze Co., Toledo
Franklin Die Casting Corp., Syracuse
Stewart Die Casting Corp., Chicago

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Bunting Brass & Bronze Co., Toledo
Phosphor Bronze Smelting Co., Phila.
Stewart Die Casting Corp., Chicago

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Franklin Die Cast. Corp., Syracuse
Milwaukee Die Cast Co., Milwaukee
Stewart Die Casting Corp., Chicago

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Bilton Machine Tool Co., Bridgeport
Brown & Sharpe Mfg. Co., Providence
Etna Machine Co., Toledo
Franklin Mach. Co., Providence
Link-Belt Co., Chicago
Springfield (O.) Mach. Tool Co.

Centering Machines
Pratt & Whitney Co., Hartford
Sundstrand Mach. Tool Co., Rockford, Ill.
Whiton Mch. Co., D. E., New London

Centers, Planer
Cincinnati (O.) Planer Co.

Chains (See Sprockets and Chains)

Chains, Driving
Boston Gear Wks., Quincy
Grant Gear Wks., Inc., Boston
Link-Belt Co., Chicago
Philadelphia (Pa.) Gear Works
Whitney Mfg. Co., Hartford

Chamfering Mchs., Automatic
Grant Mfg. & Mch. Co., Bridgeport

Checks, Metal Time & Tool
Noble & Westbrook Mfg. Co., Hartford

Chucking Machines
Brown & Sharpe Mfg. Co., Providence
Bullard Mach. Tool Co., Bridgeport
Cleveland (O.) Auto Mach. Co.
Goss & De Leeuw Mach. Co., New Britain
Jones & Lamson Mach. Co., Springfield, Vt.
National Acme Co., Cleveland, Ohio
Potter & Johnston Mch. Co., Pawtucket
Warner & Swasey Co., Cleveland

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Errington Mech. Laboratory, N. Y.
Geometric Tool Co., New Haven
Logansport (Ind.) Mach. Co.
McCrosky Tool Corp., Meadville, Pa
National Tool Co., Cleveland
Ney Co., J. M., Hartford
Wahlstrom Tool Co., Brooklyn
Whitney Mfg. Co., Hartford

Chucks, Centering
Westcott Chuck Co., Oneida

Chucks, Collet
Logansport (Ind.) Mach. Co.
Ney Co., J. M., Hartford
Sundstrand Mach. Tool Co., Rockford, Ill.

Chucks, Drill and Tap
Cleveland (O.) Twist Drill Co.
Errington Mech. Laboratory, N. Y
McCrosky Tool Corp., Meadville
Skinner Chuck Co., New Britain
Union Mfg. Co., New Britain
Wahlstrom Tool Co., Brooklyn
Westcott Chuck Co., Oneida
Whitney Mfg. Co., Hartford
Whiton Mch. Co., D. E., New London

Chucks, Horizontal Boring Mill
Barrett Machine Tool Co., Inc., Meadville, Pa.

Chucks, Lathe
Bullard Mach. Tool Co., Bridgeport
Casler, Herman, Canasota, N. Y.
Gisholt Mach. Co., Madison, Wis.
Hoggson & Pettis Mfg. Co., New Haven
Logansport (Ind.) Mach. Co.
Ney Co., J. M., Hartford
Skinner Chuck Co., New Britain
Union Mfg. Co., New Britain
Westcott Chuck Co., Oneida
Whiton Mch. Co., D. E., New London

Chucks, Magnetic
Heald Mach. Co., Worcester
Taft-Pierce Mfg. Co., Woonsocket
Walker Co., O. S., Worcester

Chucks, Planer
Cincinnati (O.) Planer Co.
Hoggson & Pettis Mfg. Co., New Haven
Skinner Chuck Co., New Britain
Union Mfg. Co., New Britain

Chucks, Split
Ames Co., B. C., Waltham
Rivett Lathe & Grinder Corp., Boston
Seneca Falls (N. Y.) Machine Co.
Stark Tool Co., Waltham

Chucks, Vertical Boring Mill
Bullard Mach. Tool Co., Bridgeport
Whiton Machine Co., D. E., New London

Chucks, Wrenchless
Wahlstrom Tool Co., Brooklyn

Clamps, Machinists'
Armstrong Bros. Tool Co., Chicago
Reed Mfg. Co., Erie.
Starrett Co., L. S., Athol, Mass.

Cleaners, Metal, Waste, General
Oakite Products, Inc., N. Y.

Clutches, Friction
Brown Co., A. & F., Elizabethport
Brown Eng. Co., Reading
Foote Bros. Gear & Mach. Co., Chicago
Johnson Mach Co., Carlyle, Manchester, Conn.
Jones Fdry. & Machine Co., W. A., Chicago
Link-Belt Co., Chicago
Moore & White Co., Philadelphia
Oesterlein Machine Co., Cincinnati
Raybestos Co., Bridgeport

Clutches, Electric Magnetic
Cutler-Hammer Mfg. Co., Milwaukee

Coal and Ash Handling Machinery
Link-Belt Co., Chicago
Shephard Electric Crane & Hoist Co., Montour Falls, N. Y.

Coal Storage Systems
Link-Belt Co., Chicago

Collars, Spacing
Detroit (Mich.) Stamping Co.

Collets
Brown & Sharpe Mfg. Co., Providence
Geometric Tool Co., New Haven
Hardinge Brothers, Inc., Chicago
Ney Co., J. M., Hartford
Rivett Lathe & Grinder Corp., Boston
Union Twist Drill Co., Athol, Mass.
Whitney Mfg. Co., Hartford

Compounds, Carbonizing (See Case Hardening, etc.)

Compounds, Cleaning
Oakite Products, Inc., N. Y.

Compounds, Cutting, Drawing, Drilling, Grinding
Oakite Products, Inc., N. Y.

Compounds, Resin
Bakelite Corp., N. Y.

Compressors, Air and Gas
Black & Decker Mfg. Co., Towson

Condensers
Ingersoll-Rand Co., N. Y.

Connecting Pins, Belt Lacing
Clipper Belt Lacer Co., Grand Rapids

Contract Work
Ames Co., B. C., Waltham
American Metal Treat. Co., Elizabeth
American Tool & Mfg. Co., Urbana
Automatic Mach. Co., Bridgeport
Bilton Machine Tool Co., Bridgeport
Boeger Meyer Mach. & Tool Co., Newark
Boston (Mass.) Scale & Machine Co.
Columbus (O.) Die T. & Mch. Co.
Detroit (Mich.) Stamping Co.
Fischer Spring Co., Chas., Brooklyn
Franklin Mch. Co., Providence.
Hartford (Conn.) Special Mchy. Co.
Hoefer Mfg. Co., Freeport, Ill.

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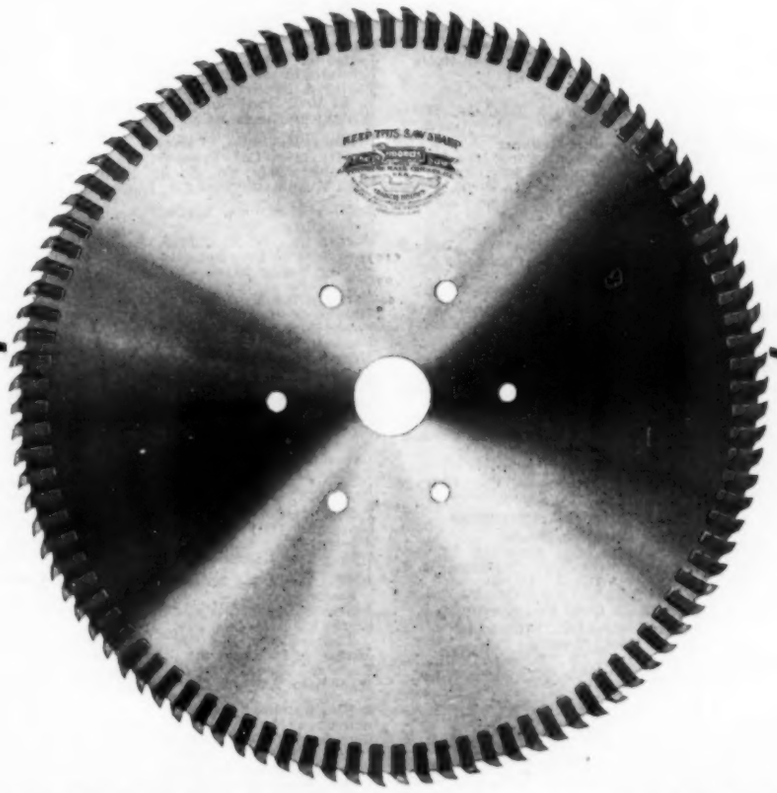

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White Dental Mfg. Co., S. S., N. Y.

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Cutler-Hammer Mfg. Co., Milwaukee

Control, Machine Tool
Cutler-Hammer Mfg. Co., Milwaukee

Controllers & Starters, Electric
Cutler-Hammer Mfg. Co., Milwaukee

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Conveyors
Standard Conveyor Co., North St Paul

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Pratt & Whitney Co., Hartford.
Slocomb Co., J. T., Providence
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Threadwell Tool Co., Greenfield.

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Brown Engineering Co., Reading
Foote Bros. Gear & Mach. Co., Chicago
Jones Fdry. & Machine Co., W. A., Chicago
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Philadelphia (Pa.) Gear Works
Smith & Serrell, Newark

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Johnson Mach. Co., Carlyle, Manchester, Conn.
Nicholson & Co., W. H., Wilkes-Barre

Cranes, Locomotive
Link-Belt Co., Chicago

Cranes, Traveling
Manning, Maxwell & Moore, N. Y.
Shaw Crane-Putnam Machine Co., Fitchburg
Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.

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Underwood Corp., H. B., Phila.

Cut Meters
Zernickow Co., O., N. Y.

Cut-outs, Electric
Wagner Electric Corp., St. Louis

Cutters for Belts
Clipper Belt Lacer Co., Grand Rapids

Cutters, Gear
Brown & Sharpe Mfg. Co., Providence
National Tool Co., Cleveland
National Twist D. & T. Co., Detroit
O. K. Tool Co., Shelton
Union Twist Drill Co., Athol, Mass.

Cutters, Keyseater
Davis Keyseater Co., Rochester

Cutters, Milling
Barber-Colman Co., Rockford
Bilton Mach. Tool Co., Bridgeport
Brown & Sharpe Mfg. Co., Providence
Geometric Tool Co., New Haven
Goddard and Goddard Co., Detroit
Ingersoll Mill. Mch. Co., Rockford
National Twist D. & T. Co., Detroit
O. K. Tool Co., Shelton
Pratt & Whitney Co., Hartford.Conn.
Reed Prentice Corp., Worcester
Union Twist Drill Co., Athol, Mass.
Whitney Mfg. Co., Hartford

Cutting-Off Machines
Armstrong-Blum Mfg. Co., Chicago.
Brown & Sharpe Mfg. Co., Providence
Etna Machine Co., Toledo
Gorton Mach. Co., Geo., Racine
Greenfield (Mass.) Tap & Die Corp.
Landis Mach. Co., Waynesboro
Pratt & Whitney Co., Hartford, Conn.

Cutting-Off Machines, Pipe (See Pipe-Cutting and Threading Machines)

Cutting-Off Tools
Armstrong Bros. Tool Co., Chicago

Dealers, Machinery (See Searchlight Section)
H. F. Allen Co., Inc., N. Y.
Bennett Machinery Co., N. Y. C.
Botwinik Bros., Inc., New Haven
Brownell Mchy. Co., Providence
DeWitt Tool Co., N. Y.
Eastern Machinery Co., Cincinnati
Eddy Machy. Co., E. A., Providence
Essley Mchy. Co., E. L., Chicago
Failor Co. Inc., R. C., N. Y.
General Machinery Co., Boston
Hill, Clarke & Co., Chicago
Hyman & Sons, Jos., Philadelphia
Manning, Maxwell & Moore, N. Y.
Miles Machinery Co., Saginaw
Morey & Co., N. Y.
Osborne & Sexton Mchy. Co., Columbus
Riverside Machinery Depot, Detroit
Scherr Co., Geo., N. Y.
Shaw-Putnam Mach. Co., Inc., Fitchburg
Simmons Mach. Tool Corp., Albany
Smith Machy. Co. H. A., Phila.
Wayne Mchy. Co., Ft. Wayne
Wickes Mchy. Co., Jersey City

Demagnetizers
Wickes Mchy. Co., Jersey City, N. J.

Diamond Tools
Desmond-Stephan Mfg. Co., Urbana
Dickinson, Thomas L., N. Y.
Bilton Mach. Tool Co., Bridgeport

Die Holders for Presses
Bilton Machine Tool Co., Bridgeport
U. S. Tool Co., Ampere, N. J.

Die Makers' Supplies
Danly Machine Specialties, Chicago

Die Making Machines
Haskins Co., R. G., Chicago
Keller Mech. Eng. Co., Brooklyn
White Dental Mfg. Co., S. S., N. Y.

Die Sets
Danly Mach. Specialties, Chicago

Dies, Forging
Keller Mech. Eng. Co., Brooklyn
White Dental Mfg. Co., S. S., N. Y.

Dies, Self-opening Adjustable
Cons. Mach. Tool Corp., Rochester
Eastern Mch. Screw Corp., New Haven
Geometric Tool Co., New Haven
Jones & Lamson Mach. Co., Springfield, Vt.
Landis Mch. Co., Waynesboro
Murchey Mach. & Tool Co., Detroit
National Acme Co., Cleveland

Dies, Sheet Metal and Sub-Press (See Contract Work)

Dies, Steel Marking
Noble & Westbrook Mfg. Co., Hartford

Dies, Threading-Opening
Eastern Mch. Screw Corp., New Haven
Geometric Tool Co., New Haven
Greenfield (Mass.) Tap & Die Corp.
Jones & Lamson Mach. Co., Springfield, Vt.
Landis Mch. Co., Waynesboro
Murchey Mach. & Tool Co., Detroit
National Acme Co., Cleveland
National Machinery Co., Tiffin.

Dividing Heads
Knight Mchy. Co., W. B., St. Louis
Schuchardt & Schutte (Geo. Scherr) N. Y.
U. S. Mch. Tool Co., Cincinnati

Dogs, Lathe & Milling Machine
Armstrong Bros. Tool Co., Chicago

Dressers, Grinding Wheel
Bay State Stamping Co., Worcester
Desmond-Stephan Mfg. Co., Urbana
Norton Co., Worcester

Drill Holders
Armstrong Bros. Tool Co., Chicago

Drill Speeders
Graham Mfg. Co., Providence

Drilling Machine Heads
Hoefer Mfg. Co., Freeport, Ill.
Langelier Mfg. Co., Cranston, R. I.
Rockford (Ill.) Drilling Machine Co.
Sellew Machine Tool Co., Pawtucket
U. S. Drill Head Co., Cincinnati

Drilling Machines, Automatic
Baker Bros., Toledo
Barnes Drill Co., Rockford, Ill.
Boeger-Meyer Mach. & Tool Co., Newark
Fox Mach. Co., Jackson, Mich.
Hoefer Mfg. Co., Freeport, Ill.
Kingsbury Mfg. Co., Keene, N. H.
Langelier Mfg. Co., Cranston, R. I.
Nat'l Automatic Tool Co., Richmond
Sundstrand Mach. Tool Co., Rockford, Ill.

Drilling Machines, Bench
Ames Co., B. C., Waltham
Barnes Co., W. F. & John, Rockford
Canedy-Otto Mfg. Co., Chicago Hgts.
Clark Electric Co., Jas., Jr., Louisville
High Speed Hammer Co., Rochester.
Hisey-Wolf Mach. Co., Cincinnati
Langelier Mfg. Co., Cranston, R. I.
Rockford (Ill.) Drilling Mach. Co.
Taylor & Fenn Co., Hartford.

Drilling Machines, Gang
Baker Bros., Toledo
Barnes Co., W. F. & John, Rockford
Barnes Drill Co., Rockford
Cincinnati (O.) Bickford Tool Co.
Foote-Burt Co., Cleveland
Fosdick Mach. Tool Co., Cincinnati
Goodell-Pratt Co., Greenfield, Mass.
Hoefer Mfg. Co., Freeport, Ill.
Langelier Mfg. Co., Cranston, R. I
Rockford (Ill.) Drilling Machine Co.
Taylor & Fenn Co., Hartford

Drilling Machines, Heavy Duty
Baker Bros., Toledo
Barnes Drill Co., Inc., Rockford
Barnes, W. F. & John, Rockford.
Cons. Mach. Tool Corp., Rochester
Foote-Burt Co., Cleveland
Fosdick Mach. Tool Co., Cincinnati
Hoefer Mfg. Co., Freeport, Ill.
Rockford (Ill.) Drilling Machine Co.

Drilling Machines, Horizontal (See Boring, Drilling and Milling Machines, Horizontal)

Drilling Machines, Multiple Spindle
Baker Bros., Toledo
Barnes Co., W. F. & John, Rockford
Barnes Drill Co., Rockford, Ill.
Boeger-Meyer Mach. & Tool Co., Newark
Cons. Mach. Tool Corp., Rochester
Foote-Burt Co., Cleveland
Fox Mach. Co., Jackson, Mich.
Grant Mfg. & Mch. Co., Bridgeport
Harrington Co., Phila.
Kingsbury Mfg. Co., Keene, N. H.
Langelier Mfg. Co., Cranston, R. I.
Moline (Ill.) Tool Co.
Nat'l Automatic Tool Co., Richmond
Pratt & Whitney Co., Hartford, Conn.
Rockford (Ill.) Drilling Mach. Co.

Drilling Machines, Radial
American Tool Wks. Co., Cincinnati
Carlton Mach. Tool Co., Cincinnati
Cincinnati (O.) Bickford Tool Co.
Dreses Mch. T. Co., Cincinnati
Fosdick Mach. Tool Co., Cincinnati
Harrington Co., Phila.
Morris Machine Tool Co., Cincinnati
Reed-Prentice Corp., Worcester
Ryerson & Son, Joseph T., Chicago
Sellers & Co., Wm., Philadelphia

Drilling Machines, Sensitive
Ames Co., B. C., Waltham
Barnes Co., W. F. & John, Rockford
Buffalo (N. Y.) Forge Co.
Canedy-Otto Mfg. Co., Chicago Hgts.
Hardinge Brothers, Inc., Chicago
High Speed Hammer Co., Rochester.
Kingsbury Mfg. Co., Keene, N. H.
Langelier Mfg. Co., Cranston, R. I.
Leland Gifford Co., Worcester
Taylor & Fenn Co., Hartford
U. S. Mch. Tool Co., Cincinnati
Wisconsin Electric Co., Racine

Drilling Machines, Turret
Hoefer Mfg. Co., Freeport, Ill.
Kingsbury Mfg. Co., Keene, N. H.
Nat'l Automatic Tool Co., Richmond.

Drilling Machines, Vertical
Baker Bros., Toledo
Barnes Co., W. F. & John, Rockford
Barnes Drill Co., Inc., Rockford
Boeger-Meyer Mach. & Tool Co., Newark
Canedy-Otto Mfg. Co., Chicago Hgts.
Cincinnati (O.) Bickford Tool Co.
Foote-Burt Co., Cleveland
Fosdick Mach. Tool Co., Cincinnati
Harrington Co., Phila.
Kingsbury Mfg. Co., Keene, N. H.
Knight Mchy. Co., W. B., St. Louis
Langelier Mfg. Co., Cranston, R. I.
Leland-Gifford Co., Worcester
Merit Oil Equipment Co., Cleveland
Rockford (Ill.) Drilling Machine Co.
Ryerson & Son, Jos. T., Chicago
Taylor & Fenn Co., Hartford
U. S. Mch. Tool Co., Cincinnati

Drills, Center
Cleveland (O.) Twist Drill Co
Slocomb Co., J. T., Providence
Union Twist Drill Co., Athol, Mass.

Drills, Portable, Electric and Pneumatic
Black & Decker Mfg. Co., Towson
Clark Electric Co., Jas., Jr., Louisville
Hisey-Wolf Mach. Co., Cincinnati
Standard Elect. Tool Co., Cincinnati
Wisconsin Electric Co., Racine

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago
Cleveland (O.) Twist Drill Co.
Goodell-Pratt Co., Greenfield, Mass.
Pratt & Whitney Co., Hartford, Conn.
Union Twist Drill Co., Athol, Mass.

Drills, Square and Hexagon
Cleveland (O.) Twist Drill Co.
Greenfield (Mass.) Tap & Die Corp.
National Twist D. & T. Co., Detroit
Union Twist Drill Co., Athol, Mass.

Electrical Instruments
Wagner Electric Corp., St. Louis
Westinghouse Elect. & Mfg. Co., East Pittsburgh

Electrical Supplies
Cutler-Hammer Mfg. Co., Milwaukee
Simplex Wire & Cable Co., Boston
Wagner Electric Corp., St. Louis
Westinghouse Elect. & Mfg. Co., East Pittsburgh

Elevating Trucks (See Trucks)

Elevators and Conveyors
Caldwell & Son Co., H. W., Chicago
Link-Belt Co., Chicago

Engineers, Industrial and Mechanical
Underwood Corp., H. B., Philadelphia

Engraving Machinery
Gorton Mach. Co., Geo., Racine
Keller Mech. Eng. Co., Brooklyn

Expanders, Tube
Watson-Stillman Co., N. Y.

Eyeglass, Safety (See Goggles, Safety)

Facing Machines
Barrett Machine Tool Co., Inc., Meadville, Pa.
Manning, Maxwell & Moore, N. Y.
Shaw Crane-Putnam Machine Co., Fitchburg

Fans, Electric
Buffalo (N. Y.) Forge Co.
Wagner Electric Corp., St. Louis
Westinghouse Elect. & Mfg. Co., East Pittsburgh

Fans, Ventilating
Wagner Electric Corp., St. Louis

Files and Rasps
Simonds Saw & Steel Co., Fitchburg.

Filing Machines
Ames Co., B. C., Waltham
Atkins & Co., E. C., Indianapolis
Haskins Co., R. G., Chicago
Oliver Instrument Co., Adrian, Mich.
White Dental Mfg. Co., S. S., N. Y.

Files, Precision
American Swiss File & Tool Co., Elizabeth, N. J.

Filler, Iron (See Cement, Iron)

Fittings, Hydraulic
Elmes Eng. Wks., Chas. F., Chicago
Watson-Stillman Co., N. Y.

Flanging Machines, Tube
Grant Mfg. & Mch. Co., Bridgeport

Forging Machinery
Acme Mchy. Co., Cleveland
National Mchy. Co., Tiffin

Furnaces & Ovens
Westinghouse Elect. & Mfg. Co., East Pittsburgh

Furnaces, Forging
American Gas Furnace Co., Elizabeth
Chicago (Ill.) Flexible Shaft Co.

Furnaces, Heat-Treating, Tempering and Annealing
American Gas Furnace Co., Elizabeth
Brown & Sharpe Mfg. Co., Providence
Chicago (Ill.) Flexible Shaft Co.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Johnson Gas Appliance Co., Cedar Rapids
Rockwell Co., Stanley P., Hartford
Strong, Carlisle & Hammond Co., Cleveland
Sentry Co., Taunton

Furniture, Machine Shop
Brown Eng. Co., Reading

Gage Blocks
Pratt & Whitney Co., Hartford, Conn.

Gages, Comparator
Federal Products Corp., Providence
Jones & Lamson Mach. Co., Springfield, Vt.

Gages, Dial
Ames Co., B. C., Waltham, Mass.
Brown & Sharpe Mfg. Co., Providence
Federal Products Corp., Providence
Lowe, Henry E., Cleveland
Starrett Co., L. S., Athol, Mass.

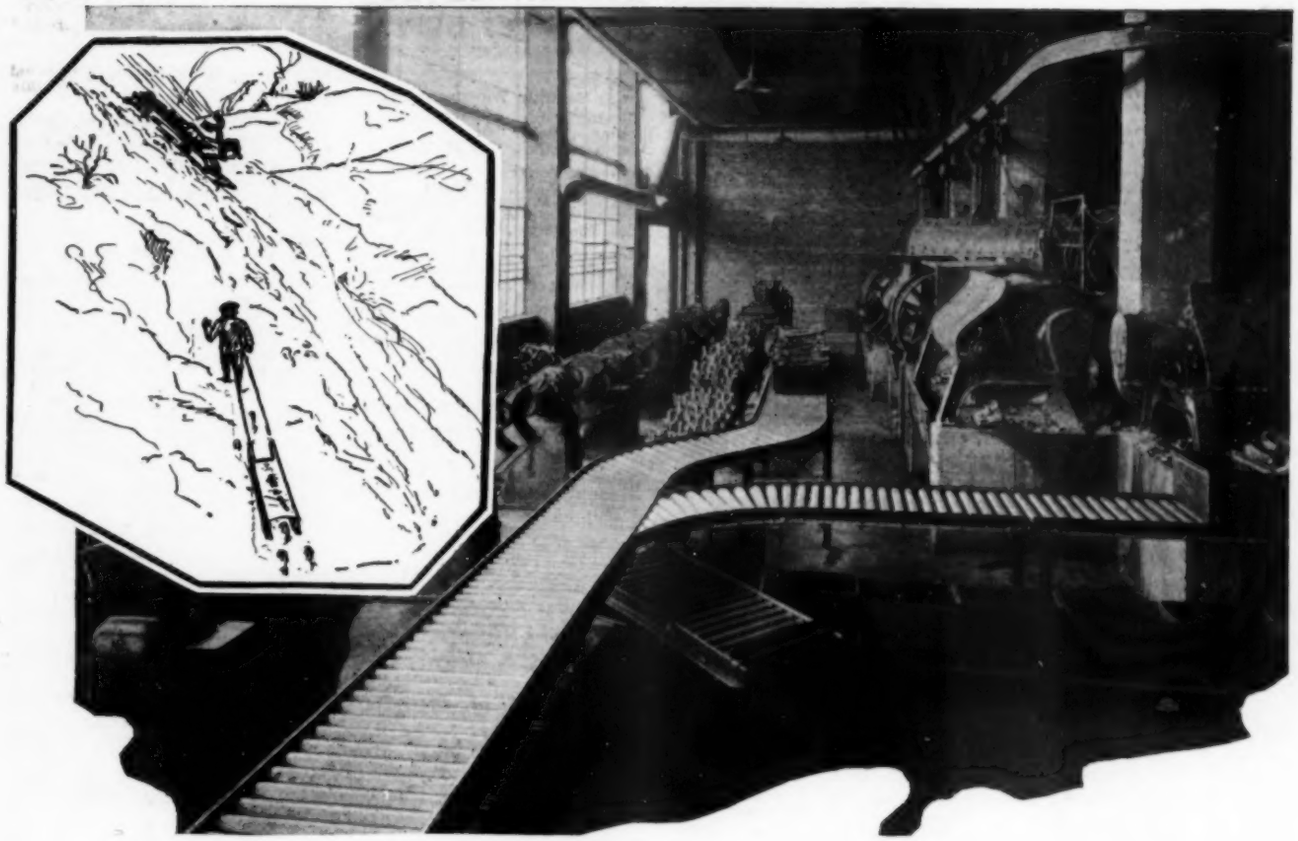
Gages, Plug and Ring
Brown & Sharpe Mfg. Co., Providence
Pratt & Whitney Co., Hartford, Conn.

Gages, Recording
Bristol Co., Waterbury

Gages, Snap, Thread and Cylindrical
Brown & Sharpe Mfg. Co., Providence
Federal Products Corp., Providence
Greenfield (Mass.) Tap & Die Corp.
Pratt & Whitney Co., Hartford, Conn.
Slocomb Co., J. T., Providence
Taft-Pierce Mfg. Co., Woonsocket

Gages, Standard
Brown & Sharpe Mfg. Co., Providence
Federal Products Corp., Providence
Greenfield (Mass.) Tap & Die Corp.
Pratt & Whitney Co., Hartford, Conn.

Gear Cutting Machines
Adams Co., Dubuque
Barber-Colman Co., Rockford
Bilgram Mch. Wks., Philadelphia
Bilton Machine Tool Co., Bridgeport
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Gear Cutting Mach. Co.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, Rochester
Harrington Co., Phila.
Newark (N. J.) Gear Cutting Mch. Co.
Schuchardt & Schutte (Geo. Scherr) N. Y.
Waltham (Mass.) Mch. Works
Whiton Mch. Co., D. E., New London



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Gleason Works, Rochester

Gear Testing Machinery
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Brown & Sharpe Mfg. Co., Providence
Gleason Works, Rochester
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Atlantic Gears Wks., Brooklyn
Brown Co., A. & F., Elizabethport
Brown & Sharpe Mfg. Co., Providence
Caldwell & Son, H. W., Chicago
Foote Bros. Gear & Machine Co., Chicago
Franklin Die Cast Corp., Syracuse
Grant Gear Works, Boston
Hartford (Conn.) Special Machy. Co.
Jones Fdry. & Machine Co., W. A., Chicago
Link-Belt Co., Chicago
Pennsylvania Gear & Machine Co., Phila.
Philadelphia (Pa.) Gear Wks.,

Gears, Cut
Adams Co., Dubuque, Iowa
Bilgram Mch. Wks., Philadelphia
Boston Gear Wks., Norfolk Downs
Brown Co., A. & F., Elizabethport
Brown & Sharpe Mfg. Co., Providence
Diefendorf Gear Corp., Syracuse
Earle Gear & Machine Co., Phila.
Fawcus Mch. Co., Pittsburgh
Fellows Gear Shaper Co., Springfield, Vt.
Foote Bros. Gear & Mach. Co., Chicago
Franklin Die Casting Corp, Syracuse
Gleason Works, Rochester
Grant Gear Works, Boston
Hartford (Conn.) Special Machy. Co.
Jones Fdry. & Machine Co., W. A., Chicago
Link-Belt Co., Chicago
Machine Products Co., Cleveland
Meisel Press Mfg. Co., Boston
Newark (N. J.) Gear Cutting Mch. Co.
Nuttall Co., R. D., Pittsburgh
Pennsylvania Gear & Machine Co., Phila.
Philadelphia (Pa.) Gear Works
Schuchardt & Schutte (Geo. Scherr Co.), N. Y.
Simonds Mfg. Co., Pittsburgh

Gears, Forged
Grant Gear Wks., Inc., Boston
Hartford (Conn.) Special Machy. Co.
Philadelphia (Pa.) Gear Works

Gears, Speed Reducing
Albaugh-Dover Mfg. Co., Chicago
Boston Gear Wks. Sales Co., Quincy
Earle Gear & Mach. Co., Phila.
Grant Gear Wks., Boston
Hartford (Conn.) Special Machy. Co.
Machine Products Co., Cleveland
Philadelphia (Pa.) Gear Works

Generators, Electric
Reliance Elect. & Eng. Co., Cleveland
Westinghouse Elect. & Mfg. Co., East Pittsburgh

Grease
Cook's Sons, Inc., Adam, N. Y.

Grinding Machines, Ball Bearing Race (See Grinding Machines, Radial)

Grinding Machines, Bench
Blount Co., J. G., Everett
Brown & Sharpe Mfg. Co., Providence
Clark Electric Co., Jas., Jr., Louisville
Diamond Mch. Co., Providence
Greenfield (Mass.) Tap & Die Corp.
Haskins Co., R. G., Chicago
Norton Co., Worcester
Ryerson & Son, Jos. T., Chicago
Union Twist Drill Co., Athol, Mass.
Walker Co., O. S., Worcester

Grinding Machines, Centerless
Cincinnati (O.) Milling Mach. Co.

Grinding Machines, Chaser
Geometric Tool Co., New Haven
Landis Mach. Co., Waynesboro

Grinding Machines, Chucking
Blanchard Mch. Co., Cambridge
Bryant Chucking Grinder Co., Springfield, Vt.
Heald Machine Co., Worcester
Landis Tool Co., Waynesboro
Rivett Lathe & Grinder Corp., Boston
Van Norman Mach. Tool Co., Springfield, Mass.

Grinding Machines, Cutter and Reamer
Barber-Colman Co., Rockford
Barnes Co., W. F. & John, Rockford
Blount Co., J. G., Everett
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Milling Mach. Co.
Diamond Mch. Co., Providence
Fafnir Bearing Co., New Britain
Gallmeyer & Livingston Co., Grand Rapids
Greenfield (Mass.) Tap & Die Corp.
Heald Mach. Co., Worcester
Landis Tool Co., Waynesboro
Norton Co., Worcester
Oesterlein Machine Co., Cincinnati
Reed-Prentice Corp., Worcester
Sellers & Co., Wm., Philadelphia
Taylor & Fenn Co., Hartford
Union Twist Drill Co., Athol, Mass.
Walker Co., O. S., Worcester

Grinding Machines, Cylindrical
Brown & Sharpe Mfg. Co., Providence
Bryant Chucking Grinder Co., Springfield, Vt.
Cincinnati (O.) Grinders, Inc.
Cons. Mach. Tool Corp., Rochester
Fitchburg (Mass.) Grinding Mach. Co.
Heald Mach. Co., Worcester
Landis Tool Co., Waynesboro
Norton Co., Worcester
Oesterlein Machine Co., Cincinnati
Van Norman Mach. Tool Co., Springfield, Mass.

Grinding Machines, Die
Abrasive Mch. T. Co., E. Providence
Blanchard Mach. Co., Cambridge
Diamond Mch. Co., Providence
Geometric Tool Co., New Haven
Heald Mch. Co., Worcester
Landis Mach. Co., Waynesboro
Murchey Mach. & T. Co., Detroit
National Mchy. Co., Tiffin
Walker Co., O. S., Worcester

Grinding Machines, Disc
Besly & Co., Chas. H., Chicago
Diamond Mch. Co., Providence

Grinding Machines, Drill and Tap
Gallmeyer & Livingston Co., Grand Rapids
Sellers & Co., Wm., Philadelphia

Grinding Machines, Face or Ring Wheel
Abrasive Mch. T. Co., E. Providence
Besly & Co., Chas. H., Chicago
Blanchard Mach. Co., Cambridge
Diamond Mch. Co., Providence
Graham Mfg. Co., Providence
Walker Co., O. S., Worcester

Grinding Machines, Floor
Blount Co., J. G., Everett
Brown & Sharpe Mfg. Co., Providence
Diamond Mch. Co., Providence
Hisey-Wolf Mach. Co., Cincinnati,
Norton Co., Worcester
Ryerson & Son, Jos. T., Chicago
Walker Co., O. S., Worcester

Grinding Machines, Gage
Abrasive Mch. T. Co., E. Providence
Landis Tool Co., Waynesboro

Grinding Machines, Hob
Zernickow Co., O., N. Y.

Grinding Machines, Internal
Bryant Chucking Grinder Co., Springfield, Vt.
Cincinnati (O.) Grinders, Inc.
Greenfield (Mass.) Tap & Die Corp.
Heald Machine Co., Worcester
Hjorth Lathe & Tool Co., Boston
Landis Tool Co., Waynesboro
Rivett Lathe & Grinder Corp., Boston
Universal Grinding Mach. Co., Fitchburg, Mass.
Van Norman Mach. Tool Co., Springfield, Mass.
Walker Co., O. S., Worcester

Grinding Machines, Piston Ring
Heald Machine Co., Worcester, Mass

Grinding Machines, Portable
Armstrong-Blum Mfg. Co., Chicago
Black & Decker Mfg., Co., Towson
Clark, Jr., Elec. Co., Jas., Louisville
Haskins Co., R. G., Chicago
Hisey-Wolf Mach. Co., Cincinnati
Standard Elect. Tool Co., Cincinnati
White Dental Mfg. Co., S. S., N. Y.
Wisconsin Electric Co., Racine

Grinding Machines, Pulley
Graham Mfg. Co., Providence

Grinding Machines, Radial
Van Norman Mach. Tool Co., Springfield, Mass.

Grinding Machines, Snagging
Blount Co., J. G., Everett
Diamond Mch. Co., Providence

Grinding Machines, Surface
Abrasive Mch. T. Co., E. Providence
Blanchard Mch. Co., Cambridge
Brown & Sharpe Mfg. Co., Providence
Diamond Mch. Co., Providence
Heald Mach. Co., Worcester
Norton Co., Worcester
Pratt & Whitney Co., Hartford, Conn.
Walker Co., O. S., Worcester

Grinding Machines, Tappet
Fitchburg (Mass.) Grinding Mach. Co.

Grinding Machines Universal
Brown & Sharpe Mfg. Co., Providence
Cincinnati, (O.) Grinders, Inc.
Gallmeyer & Livingston Co., Grand Rapids
Gisholt Mach. Co., Madison, Wis.
Greenfield (Mass.) Tap & Die Corp.
Landis Tool Co., Waynesboro
Norton Co., Worcester

Grinding Machines, Valve Seat
Fitchburg (Mass.) Grinding Mach. Co.

Grinding Wheels
Norton Co., Worcester

Guns, Paint
Spraco Painting Equipment Co., Boston

Hammers, Drop
Niles Tool Works Co., N. Y.

Hammers, Power
Bliss Co., E. W., Brooklyn
High Speed Hammer Co., Rochester,
Ryerson & Son, Joseph T., Chicago
Niles Tool Wks., Hamilton

Hammers, Soft Metal
Bilton Machine Tool Co., Bridgeport
Husky Wrench Co., Milwaukee

Hangers, Shaft
American Pulley Co., Phila.
Brown & Sharpe Mfg. Co., Providence
Fafnir Bearing Co., New Britain
Jones Fdry. & Machine Co., W. A., Chicago

Hardness Measuring Instruments, Steel
Shore Instrument & Mfg. Co., Jamaica, N. Y.

Heaters, Rivet
American Gas Furnace Co., Elizabeth, N. J.
Buffalo (N. Y.) Forge Co.

Hobbing Machines
Adams Co., Dubuque
Barber-Colman Co., Rockford
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Gear Cutting Mach. Co.
Newark (N. J.) Gear Cutting Mch. Co.
Zernickow Co., O., N. Y.

Hobs
Barber-Colman Co., Rockford
Brown & Sharpe Mfg. Co., Providence
Greenfield (Mass.) Tap & Die Corp.
National Tool Co., Cleveland
National Twist D. & T. Co., Detoit
Newark (N. J.) Gear Cutting Mch. Co.
Philadelphia (Pa.) Gear Works
Union Twist Drill Co., Athol, Mass.

Hoists & Cranes Electric & Traveling
Elwell Parker Electric Co., Cleveland
Link-Belt Co., Chicago
Shepard Elec. Crane & Hoist Co., Montour Falls

Hoists, Hand
Ford Chain Block Co., Phila.
Harrington Co., Phila.

Honing Machines
Barnes Drill Co., Rockford, Ill.

Hydraulic Machinery
Elmes Eng. Wks., Chas. F., Chicago
Watson-Stillman Co., N. Y.

Indicators, Speed and Test
Brown & Sharpe Mfg. Co., Providence
Lowe, Henry E., Cleveland
Starrett Co, L. S., Athol, Mass.
Veeder Mfg. Co., Hartford
Waterston, J. M., Detroit

Jacks, Hydraulic
Watson-Stillman Co., N. Y.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago

Jigs and Fixtures (See Contract Work)

Joints, Universal
Boston Gear Works, Norfolk Downs
Fox Mach. Co., Jackson, Mich.
Gray & Prior Mach. Co., Hartford
Nat'l Automatic Tool Co., Richmond

Kettles, Soda
Brown & Sharpe Mfg. Co., Providence
Gray & Prior Mch. Co., Hartford

Keyseating Machines
Baker Bros., Toledo
Davis Keyseater Co., Rochester
Lapointe Co., J. N., New London
Lapointe Mach. Tool Co., Hudson
Mitts & Merrill, Saginaw

Keys, Machine
Whitney Mfg. Co., Hartford

Lacing Steel
Clipper Belt Lacer Co., Grand Rapids

Lapping Machines, Cylindrical and Flat
Bethel-Player Co., Westboro, Mass.
Moline (Ill.) Tool Co.

Lathe Attachments
Ames, B. C. Waltham
Dalton Tool Corp., New York
Flather Co., Nashua
Rivett Lathe & Grinder Corp., Boston

Lathe, Dogs
West Steel Casting Co., Cleveland

Lathe Tools
Armstrong Bros. Tool Co., Chicago
Western Tool & Mfg. Co., Springfield

Lathes, Automatic and Semi-Automatic
Gisholt Mach. Co., Madison, Wis.
Jones & Lamson Mch. Co., Springfield, Vt.
National Acme Co., Windsor, Vt.
Potter & Johnston Mch. Co., Pawtucket.
Pratt & Whitney Co., Hartford, Conn.
Reed-Prentice Corp., Worcester
Seneca Falls (N. Y.) Machine Co.
Steinle Turret Mch. Co., Madison, Wis.
Sundstrand Mach. Tool Co., Rockford, Ill.

Lathes, Bench
Ames Co., B. C., Waltham
Blount Co., J. G., Everett
Brown & Sharpe Mfg. Co., Providence
Dalton Tool Corp., New York
Diamond Mch. Co., Providence
Hardinge Brothers, Inc., Chicago
Hjorth Lathe & Tool Co., Boston
Pratt & Whitney Co., Hartford, Conn.
Rivett Lathe & Grinder Corp., Boston
Seneca Falls (N. Y.) Machine Co.
South Bend (Ind.) Lathe Works
Stark Tool Co., Waltham
Van Norman Mach. Tool Co., Springfield, Mass.

Lathes, Boring
Manning, Maxwell & Moore, N. Y.
Potter & Johnston Mch. Co., Pawtucket
Shaw Crane-Putnam Machine Co., Fitchburg
Sundstrand Mach. Tool Co., Rockford, Ill.

Lathes, Chucking (See Lathes, Horizontal and Vertical Turret)

Lathes, Engine
American Tool Wks. Co., Cincinnati
Barnes Co., W. F. & John, Rockford
Blount Co., J. G., Everett
Boye & Emmes Mach. Tool Co., Cincinnati
Cisco Mach. Tool Co., Cincinnati
Cons. Mach. Tool Corp., Rochester
Dalton Tool Corp., New York
Flather Co., Nashua
Greaves-Klusman T. Co., Cincinnati
Lodge & Shipley Mch. T. Co., Cincinnati.
Manning, Maxwell & Moore, N. Y.
Monarch Machine Tool Co., Sidney
Morris Machine Tool Co., Cincinnati
Niles Tool Works Co., N. Y.
Porter-McLeod Tool Wks., Hartfield
Pratt & Whitney Co., Hartford, Conn.
Reed-Prentice Corp., Worcester
Ryerson & Son, Jos. T., Chicago
Seneca Falls (N. Y.) Machine Co.
Shaw Crane-Putnam Machine Co., Fitchburg
South Bend (Ind.) Lathe Works
Springfield (O.) Mach. Tool Co.
Sundstrand Mach. Tool Co., Rockford, Ill.

Lathes, Extension and Gap
American Tool Wks. Co., Cincinnati
Harrington Co., Phila.
South Bend (Ind.) Lathe Works

Lathes, Foot Power
Barnes Co., W. F. & John, Rockford
Dalton Tool Corp., New York
Seneca Falls (N. Y.) Machine Co.

Lathes, Horizontal and Vertical Turret
Acme Mach. Tool Co., Cincinnati
Bullard Mach. Tool Co., Bridgeport
Gisholt Mach. Co., Madison, Wis.
International Mch.T.Co., Indianapolis
Jones & Lamson Mach. Co., Springfield, Vt.
Niles Tool Works Co., N. Y.
Pratt & Whitney Co., Hartford, Conn.
Steinle Turret Mch. Co., Madison.
Warner & Swasey Co., Cleveland

Lathes, Polishing (See Polishing and Buffing Machines)

Lathes, Spinning
Adriance Mach. Wks., Brooklyn

Lathes, Toolroom
American Tool Wks. Co., Cincinnati
Hardinge Brothers, Inc., Chicago
Lodge & Shipley Mach. Tool Co., Cincinnati, O.
Manning, Maxwell & Moore, N. Y.
Porter-McLeod Tool Wks., Hartfield
Pratt & Whitney Co., Hartford, Conn.
Shaw Crane-Putnam Machine Co., Fitchburg
Sundstrand Mach. Tool Co., Rockford, Ill.

Lathes, Woodturning
Barnes Co., W. F. & John, Rockford
Blount, Co., J. G., Everett
Seneca Falls (N. Y.) Machine Co.

Letters and Figures
Brown & Sharpe Mfg. Co., Providence
Hoggson & Pettis Mfg. Co., New Haven.

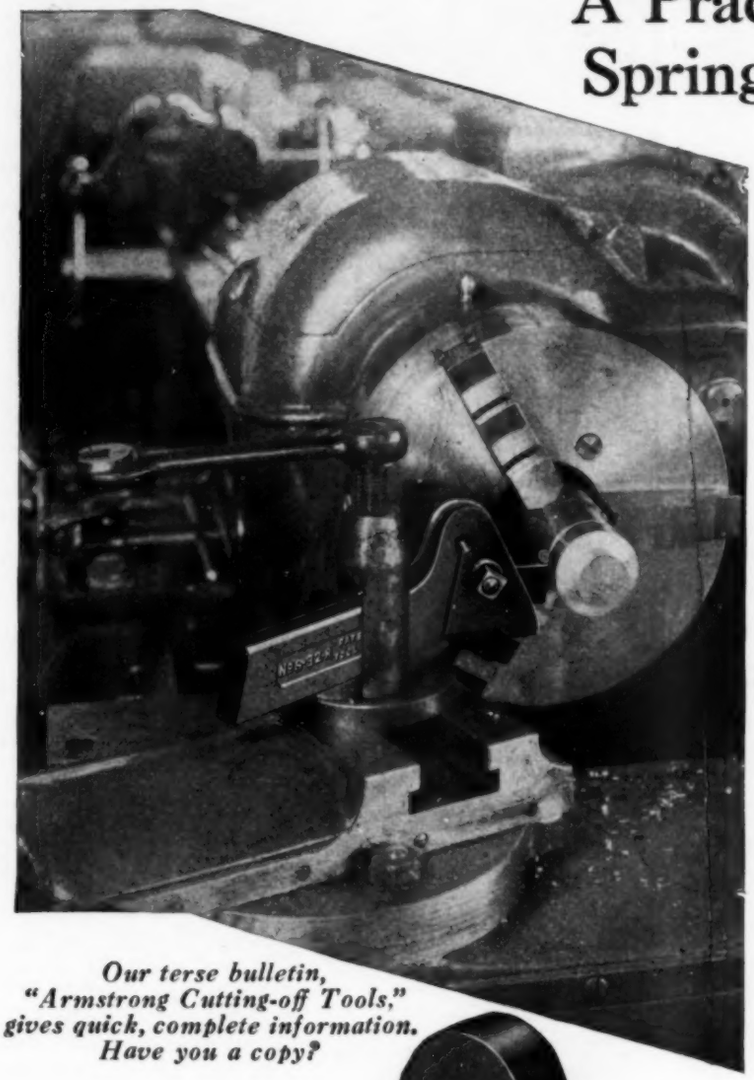
Level Precision Machines, Aligning
Pratt & Whitney Co., Hartford, Conn.
Universal Boring Mach. Co., Hudson,

Lining, Brake & Clutch
Raybestos Co., Bridgeport

Lubricants
Cook's Sons, Inc., Adam, N. Y.
Oakite Products, Inc., N. Y.

LEADING PLANTS HAVE *STANDARDIZED* ON ARMSTRONG TOOL HOLDERS

A Practical Spring Cutting-Off Tool

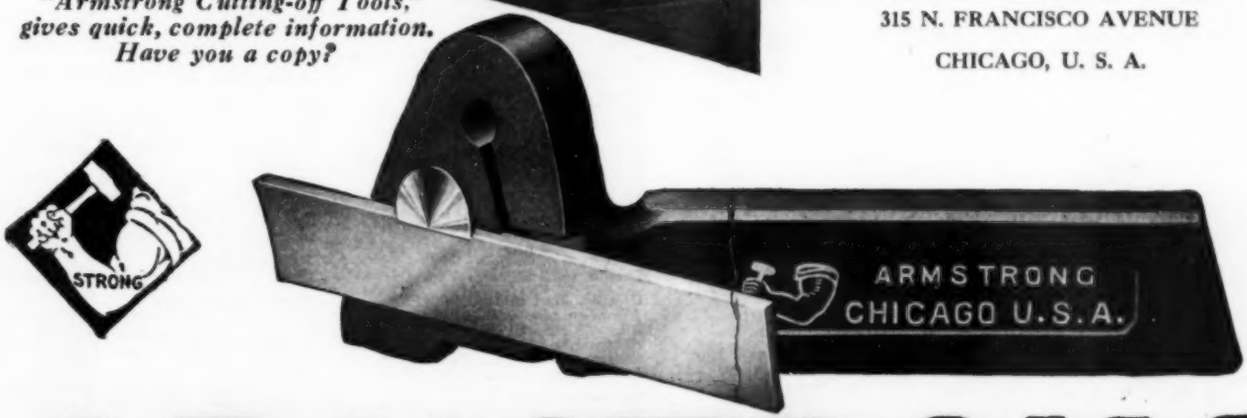


Cutting off in a lathe, heretofore always regarded as the hardest of lathe work, has been made comparatively simple by the Armstrong Spring Cutting-Off Tool. The "goose neck" form of this tool gives the cutter a resiliency that takes up any chatter and keeps the work from climbing up on the tool—the cause of practically all cutting-off tool breakage.

In no other form of forged lathe tool is the proportionate cost of maintenance compared with effective work done so great as in the cutting off tool. Consequently, in this class of work, the Armstrong System is especially effective and economical.

Our terse bulletin, "Armstrong Cutting-off Tools," gives quick, complete information. Have you a copy?

ARMSTRONG BROS. TOOL CO.
315 N. FRANCISCO AVENUE
CHICAGO, U. S. A.



ARMSTRONG TOOL HOLDERS

TRADE MARK REG. IN U.S. PAT. OFFICE

Machinery, Small Tool
Goodell-Pratt Co., Greenfield, Mass.
Taft-Pierce Mfg. Co., Woonsocket

Machinery, Small Tools
Armstrong Bros. Tool Co., Chicago
Brown & Sharpe Mfg. Co., Providence
Cutler-Hammer Mfg. Co., Milwaukee
Prentiss & Co., Henry, N. Y.
Slocomb Co., J. T., Providence
Starrett Co., L. S., Athol, Mass.

Magnets, Lifting
Ohio Electric & Controller Co., Cleveland
Cutler-Hammer Mfg. Co., Milwaukee

Mandrels, Expanding
Brown & Sharpe Mfg. Co., Providence
Logansport (Ind.) Mach. Co.
Nicholson & Co., W. H., Wilkes-Barre

Mandrels, Solid
Brown & Sharpe Mfg. Co., Providence
Cleveland (O.) Twist Drill Co.
Nicholson & Co., W. H., Wilkes-Barre
Pratt & Whitney Co., Hartford, Conn.
Union Twist Drill Co., Athol, Mass.

Marking Devices (See Stamps, Steel)

Marking Machines
Hjorth Lathe & Tool Co., Boston
Noble & Westbrook Mfg. Co., Hartford

Marking Tools
Schmidt, Geo. T., Chicago

Measuring Machines
Bethel-Player Co., Westboro, Mass.
Pratt & Whitney Co., Hartford, Conn.

Meters, Steam Flow
General Electric Co., Schenectady
Schuchardt & Schutte (Geo. Scherr) N. Y.

Micrometers, Bench
Pratt & Whitney Co., Hartford, Conn.
Starrett Co., L. S., Athol, Mass.

Micrometer Calipers
Brown & Sharpe Mfg. Co., Providence
Slocomb Co., J. T., Providence
Starrett Co., L. S., Athol, Mass.

Milling Attachments
Adams Co., Dubuque, Ia.
Bilton Machine Tool Co., Bridgeport
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Milling Mach. Co.
Ingersoll Mill. Mch. Co., Rockford
Kearney & Trecker, Milwaukee
Niles Tool Wks., Hamilton
Oesterlein Machine Co., Cincinnati
Potter & Johnston Mch. Co., Pawtucket
Reed-Prentice Corp., Worcester
Rockford (Ill.) Milling Mach. Co.
Whitney Mfg. Co., Hartford

Milling Cutters, Salvage
Eastern Cutter Salvage Corp., Newark

Milling Machines, Automatic
Bilton Machine Tool Co., Bridgeport
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Milling Mach. Co.
Ingersoll Mill Mich. Co., Rockford
Pratt & Whitney Co., Hartford, Conn.
Sundstrand Mach. Tool Co., Rockford, Ill.

Milling Machines, Bench
Ames Co., B. C., Waltham
Hardinge Brothers, Inc., Chicago
Pratt & Whitney Co., Hartford, Conn.
Stark Tool Co., Waltham
Sundstrand Mach. Tool Co., Rockford, Ill.
Van Norman Mach. Tool Co., Springfield, Mass.

Milling Machines, Continuous
Bilton Machine Tool Co., Bridgeport
Cons. Mach. Tool Corp., Rochester
Ingersoll Mill. Mch. Co., Rockford
Potter & Johnston Mch. Co., Pawtucket.
Sundstrand Mach. Tool Co., Rockford, Ill.

Milling Machines, Duplex
Bilton Machine Tool Co., Bridgeport
Cincinnati (O.) Milling Mach. Co.
Ingersoll Mill. Mch. Co., Rockford
Knight Mchy. Co., W. B., St. Louis
Van Norman Mach. Tool Co., Springfield, Mass.

Milling Machines, Hand
Adams & Co., Dubuque, Iowa
Bilton Machine Tool Co., Bridgeport
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Milling Mach. Co.
Pratt & Whitney Co., Hartford, Conn.
Sundstrand Mach. Tool Co., Rockford, Ill.
U. S. Mch. Tool Co., Cincinnati
Van Norman Mach. Tool Co., Springfield, Mass.
Whitney Mfg. Co., Hartford

Milling Machines, Horizontal and Planer Type
Cincinnati (O.) Planer Co.
Cons. Mach. Tool Corp., Rochester
Ingersoll Mill. Mch. Co., Rockford
Manning, Maxwell & Moore, N. Y.
Niles Tool Works Co., N. Y.
Shaw Crane-Putnam Machine Co., Fitchburg

Milling Machines, Plain
Bilton Machine Tool Co., Bridgeport
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Milling Mach. Co.
Ingersoll Mill. Mch. Co., Rockford
Kearney & Trecker, Milwaukee
Oesterlein Machine Co., Cincinnati
Potter & Johnston Mch. Co. Pawtucket
Ryerson & Son, Joseph T., Chicago
Sundstrand Mach. Tool Co., Rockford, Ill.
U. S. Mch. Tool Co., Cincinnati
Van Norman Mach. Tool Co., Springfield, Mass.

Milling Machines, Portable
Ingersoll Mill Mach. Co., Rockford
Underwood Corp., H. B., Phila.

Milling Machines, Thread
Automatic Mach. Co., Bridgeport
Bilton Machine Tool Co., Bridgeport
Hall Planetary Co., Philadelphia
Harrington Co., Phila.
Pratt & Whitney Co., Hartford, Conn.
Taft-Pierce Mfg. Co., Woonsocket
Waltham (Mass.) Mch. Works

Milling Machines, Universal
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Milling Mach. Co.
Hendey Machine Co., Torrington
Ingersoll Mill. Mch. Co., Rockford
Kearney & Trecker, Milwaukee
Oesterlein Mach. Co., Cincinnati
Potter & Johnston Mch. Co., Pawtucket
Ryerson & Son, Joseph T. Chicago
Sundstrand Mach. Tool Co., Rockford, Ill.
U. S. Mch. Tool Co., Cincinnati
Van Norman Mach. Tool Co., Springfield, Mass.

Milling Machines, Vertical
Ames Co., B. C., Waltham
Automatic Mach. Co., Bridgeport
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Milling Mach. Co.
Cons. Mach. Tool Corp., Rochester
Ingersoll Mill. Mch. Co., Rockford
Kearney & Trecker, Milwaukee
Knight Mchy. Co., W. B., St. Louis
Niles Tool Works Co., N. Y.
Potter & Johnston Mch. Co., Pawtucket
Reed-Prentice Corp., Worcester
Sundstrand Mach. Tool Co., Rockford, Ill.
Van Norman Mach Tool Co., Springfield, Mass.

Milling Machines, Worm
Bilton Machine Tool Co., Bridgeport
Cleveland (O.) Auto Mach. Co.
Pratt & Whitney Co., Hartford, Conn.
Waltham (Mass.) Mch. Works
Zernickow Co., O., N. Y.

Milling Tools, Adjustable Hollow
Geometric Tool Co., New Haven

Motors, Electric
Burke Electric Co., Erie
Lincoln Electric Co., Cleveland
Ohio Electric & Controller Co., Cleveland
Reliance Elec. & Eng. Co., Cleveland
Wagner Electric Corp., St. Louis
Westinghouse Elect. & Mfg. Co., East Pittsburgh
Wisconsin Electric Co., Racine

Name Plates
Schwerdtle Stamp Co., Bridgeport

Nitrogen, Gas
Linde Air Products Co., N. Y.

Numbering Machines
Noble & Westbrook Mfg. Co., Hartford

Nut Tappers (See Bolt and Nut Machinery

Nuts, Lock (See Lock-Nuts)

Oil Burning System Fuel
Chicago (Ill.) Flexible Shaft Co.

Oil and Grease Cups
Bay State Stamping Co., Wocester
Gits Bros. Mfg. Co., Chicago
Tucker, W. A. & C. F., Hartford

Oil Grooving Machines
Hanson-Whitney Mach. Co., Hartford

Oil Stones
Norton Co., Worcester

Oil Storage Equipment
Gilbert & Barker Mfg. Co., Springfield, Mass.

Oxygen, Gas
Linde Air Products Co., N. Y.

Paints
Spraco Painting Equipment Co., Boston

Painting Equipment
Ingersoll-Rand Co., N. Y.
Spraco Painting Equipment Co., Boston

Parallels
Starrett Co., L. S., Athol, Mass.
Pattern Shop Machinery (See Woodworking Machinery)

Patterns, Wood and Metal
Mehl Mch. T. & Die Co., Roselle,

Pillow Blocks (Set Block Pillow)

Pins, Leader
Danly Machine Specialties, Chicago

Pipe Bending Machines
Harrington Co., Phila.
Underwood Corp., H. B., Phila.

Pipe Cutting and Threading Machines
Greenfield (Mass.) Tap & Die Corp.
Harrington Co., Phila.
Merrell Mfg. Co., Toledo
Niles Tool Works Co., N. Y.
Ryerson & Son, Jos. T., Chicago
Saunders Sons, D., Yonkers

Pipe Facing Machines
Barrett Machine Tool Co., Inc., Meadville, Pa.

Pipe Fitters Tools
Cleveland (O.) Twist Drill Co.
Greenfield (Mass.) Tap & Die Corp.

Pipe, Steel
National Tube Co., Pittsburgh

Planing Machines
American Tool Wks. Co., Cincinnati
Automatic Mch. Co., Bridgeport
Cincinnati (O.) Planer Co.
Cleveland (O.) Planer Co.
Cons. Mach. Tool Corp., Rochester
Gray Co., G. A., Cincinnati
Manning, Maxwell & Moore, N. Y.
Niles Tool Works Co., N. Y.
Ryerson & Son, Joseph T., Chicago
Sellers & Co., Wm., Philadelphia
Shaw Crane-Putnam Machine Co., Fitchburg

Planing Machines, Rotary
Underwood Corp., H. B., Phila.

Pneumatic Tools
Anderson Bros. Mfg. Co., Rockford

Pointing Machines
Kent Machine Co., Cuyahoga Falls

Polishing and Buffing Machines
Barnes Co., W. F. & John, Rockford
Blanchard Mch. Co., Cambridge
Blount Co., J. G., Everett
Brown & Sharpe Mfg. Co., Providence
Bryant Chucking Grinder Co., Diamond Mch. Co., Providence
Greenfield (Mass.) Tap & Die Corp.
Heald Mch. Co., Worcester
Landis Tool Co., Waynesboro
Rowbottom Machine Co., Waterbury
Standard Elect. Tool Co., Cincinnati
Union Twist Drill Co., Athol, Mass.
Van Norman Mach. Tool Co., Springfield, Mass.
Wisconsin Electric Co., Racine

Press Accessories, Punch
Danly Machine Specialties, Inc., Chicago

Press Feeds
Littell Mach. Co., F. J., Chicago
V & O Press Co., Hudson

Presses, Arbor
Barnes Co., W. F. & John, Rockford
Logansport (Ind.) Machine Co., The
Nicholson & Co., W. H., Wilkes-Barre

Presses, Drop and Forging
Bliss Co., E. W., Brooklyn
Niagara Machine & Tool Wks., Buffalo
Toledo (O.) Mch. & Tool Co.

Presses, Foot and Hand
Adriance Mach. Wks., Brooklyn
Bliss Co., E. W., Brooklyn
Niagara Mach. & Tool Wks., Buffalo
Shuster Co., F. B., New Haven
Taylor & Fenn Co., Hartford

Presses, Forcing
Barnes Co., W. F. & John, Rockford
Elmes Eng. Wks., Chas. F., Chicago

Presses, Hydraulic
Elmes Eng. Wks., Chas. F., Chicago
Watson-Stillman Co., N. Y.

Presses, Power
Adriance Mch. Wks., Brooklyn
Barnes Co., W. F. & John, Rockford
Bliss Co., E. W., Brooklyn
Federal Press Co., Elkhart
Fox Mach. Co., Jackson, Mich.
Niagara Mach. & Tool Wks., Buffalo
Rockford (Ill.) Iron Works
Rowbottom Machine Co., Waterbury
Toledo (O.) Mch. & Tool Co.

Presses, Screw
Barnes Co., W. F. & John, Rockford
Bliss Co., E. W., Brooklyn

Profiling Machines
Automatic Mch. Co., Bridgeport
Fischer Machine Co., Phila.
Pratt & Whitney Co., Hartford, Conn.
Stark Tool Co., Waltham

Pulleys, Metal
American Pulley Co., Philadelphia
Brown Co., A. & F., Elizabethport
Brown & Sharpe Mfg. Co., Providence
Caldwell & Son Co., H. W., Chicago
Johnson Mach. Co., Carlyle, Manchester, Conn.
Jones Fdry. & Machine Co., W. A. Chicago

Pulleys, Steel Split
American Pulley Co., Philadelphia

Pumps, Hydraulic
Buffalo (N. Y.) Forge Co.
Elmes Eng. Wks., Chas. F. Chicago

Pumps, Lubricant and Oil
Brown & Sharpe Mfg. Co., Providence

Punches, Center
Brown & Sharpe Mfg. Co., Providence
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Armstrong-Blum Mfg. Co., Chicago

Punches, Power
Buffalo (N. Y.) Forge Co.
Mitts & Merrill, Saginaw
Niagara Mch. & T. Wks., Buffalo
Ryerson & Son, Joseph T., Chicago
Watson-Stillman Co., N. Y.

Punching and Shearing Machines
Buffalo (N. Y.) Forge Co.
Cons. Mach. Tool Corp., Rochester

Pyrometers, Electric
Bristol Co., Waterbury

Rack Cutting Machines See (Gear Cutting Mach.)

Racks, Cut
Boston Gear Wks., Quincy, Mass.
Grant Gear Wks., Inc., Boston
Hartford (Conn.) Special Machy. Co.
Meisel Press Mfg. Co., Boston

Racks, Storage (See Furniture, Machine Shop)

Rammers, Foundry
Brown & Sharpe Mfg. Co., Providence

Reamer Holders
Landis Mach. Co., Waynesboro
McCrosky Tool Corp., Meadville, Pa.
Nicholson & Co., W. H., Wilkes-Barre

Reamers, Adjustable
Cleveland (O.) Twist Drill Co.
Gammonds Holman Co., Manchester,
Gisholt Mach. Co., Madison, Wis.
Greenfield (Mass.) Tap & Die Corp.
McCrosky Tool Corp., Meadville, Pa.
National Twist D. & T. Co., Detroit
Pratt & Whitney Co., Hartford, Conn.
Taft-Pierce Mfg. Co., Woonsocket

Reamers, Solid
Bilton Machine Tool Co., Bridgeport
Cleveland (O.) Twist Drill Co.
Gammons-Holman Co., Manchester,
Greenfield (Mass.) Tap & Die Corp.
Hjorth Lathe & Tool Co., Boston
Manchester (Conn.) Tool Co.
National Tool Co., Cleveland
Pratt & Whitney Co., Hartford, Conn.
Reed Mfg. Co., Erie
Union Twist Drill Co., Athol, Mass.

Reamers, Taper
Bilton Machine Tool Co., Bridgeport
Brown & Sharpe Mfg. Co., Providence
Gammons-Holman Co., Manchester, Conn.
Greenfield (Mass.) Tap & Die Corp.
Manchester (Conn.) Tool Co.
Pratt & Whitney Co., Hartford, Conn.
Threadwell Tool Co., Greenfield,
Union Twist Drill Co., Athol, Mass.

Reaming Machines
The Blanchard Mach. Co., Cambridge

Recorders, Pressure
Bristol Co., Waterbury

Recorders, Temperature
Bristol Co., Waterbury

Rheostats
Cutler-Hammer Mfg. Co., Milwaukee
Westinghouse Elect. & Mfg. Co., East Pittsburgh

Riveters
High Speed Hammer Co., Rochester.

Rivet Sets
Hunter Saw & Mch. Co., Pittsburgh

Rivet Making Machinery
National Machinery Co., Tiffin

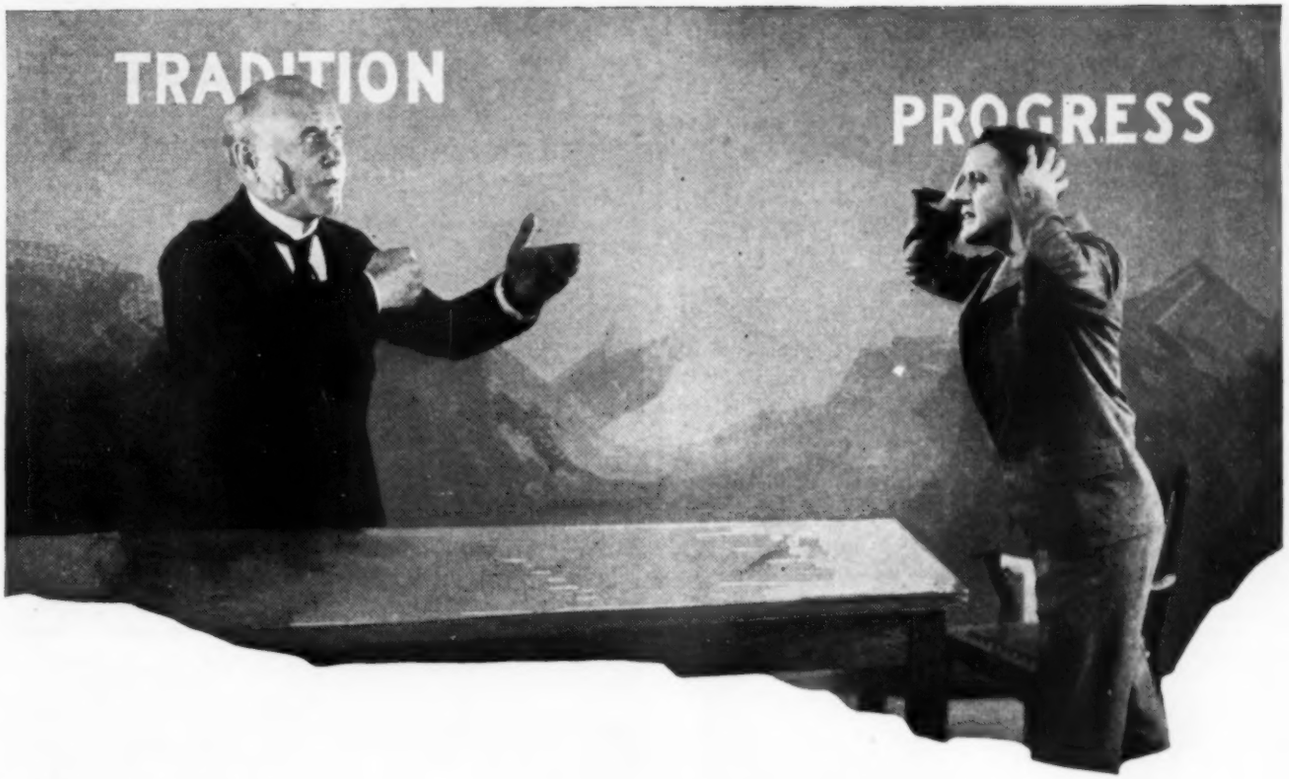
Riveting Machines
Grant Mfg. & Machine Co., Bridgeport
High Speed Hammer Co., Rochester.
Ryerson & Son, Jos. T., Chicago
Shuster Co., F. B., New Haven

Rod Cutters
Tucker, W. A. & C. F., Hartford

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence
Lufkin Rule Co., Saginaw
Starrett Co., L. S., Athol, Mass.

Rust Preventives
Oakite Products, Inc., N. Y.

A weighty argument from Lad



"Here, Lad—

I've been going over our manufacturing costs and you might as well know now as any time that I don't see where "Stable-Arc" welding will help our costs at all. Now, that's talking straight from the shoulder."

"Yes, Pop—

but it's too bad that the talk didn't originate a little higher up.

A brain throb, rather than a wave of the arm would show you that weight saving is a big item on machine construction, and steel "Stable-Arc" welded gives us that.

Another brain throb would indicate to you that strength is the big factor in machine construction and that "Stable-Arc" welded steel, giving as it does a construction stronger than the same steel riveted, is just what is needed.

And of course "Stable-Arc" welding being cheaper and faster than any other way shows that you gave no warm, kindly thought to the matter—just the customary cold shoulder."

A new textbook on Arc Welding (Price $1.50) will be sent on approval for five days to any executive requesting it.
Book size, 6" x 9"—total pages, 160—number of illustrations, 200—Charts, 62—Divisions, 8.

The Lincoln Electric Co., Dept. No. 3-12, Cleveland, Ohio

W-16 A.

"Stable-Arc" LINCOLN WELDER

Saw Frames and Blades
American Saw & Mfg. Co., Springfield
Starrett Co., I. S., Athol, Mass.
Simonds Saw & Steel Co., Fitchburg,
Thompson & Son Co., Henry G., New Haven, Conn.

Saw Sharpening Machines
Hunter Saw & Mch. Co., Pittsburgh
Simonds Saw & Steel Co., Fitchburg,

Sawing Machines, Metal
Armstrong-Blum Mfg. Co., Chicago
Earle Gear & Mach. Co., Phila.
Greenfield (Mass.) Tap & Die Corp.
Peerless Machine Co., Racine
Thompson & Son Co., Henry G., New Haven, Conn.

Sawing Machines, Power Hack
Armstrong-Blum Mfg. Co., Chicago
Peerless Machine Co., Racine
Western Tool & Mfg. Co., Springfield

Saws, Band
Simonds Saw & Steel Co., Fitchburg, Mass.
Thompson & Son Co., Henry G. New Haven, Conn.

Saws, Circular, Metal Cutting
Barber-Colman Co., Rockford
Hunter Saw & Mach. Co., Pittsburgh
Simonds Saw & Steel Co., Fitchburg,
Union Twist Drill Co., Athol, Mass.

Saws, Circular Wood
Simonds Saw & Steel Co., Fitchburg,

Saws, Hand and Cross Cut
Simonds Saw & Steel Co., Fitchburg.

Saws, Inserted Tooth
Simonds Saw & Steel Co., Fitchburg,

Saws, Metal Cutting
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Barber-Colman Co., Rockford
Brown & Sharpe Mfg. Co., Providence
National Tool Co., Cleveland
National Twist D. & T. Co., Detroit
Simonds Saw & Steel Co., Fitchburg,

Saws, Screw Slotting
Barber-Colman Co., Rockford
Brown & Sharpe Mfg. Co., Providence
Simonds Saw & Steel Co., Fitchburg,
Union Twist Drill Co., Athol, Mass.

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Lufkin Rule Co., Saginaw
Starrett Co., L. S., Athol, Mass.

Scraping Machs., Metal
Anderson Bros. Mfg. Co., Rockford

Screw-Machine Work
Eastern Mch. Screw Corp., New Haven
Morris Machine Tool Co., Cincinnati
National Acme Co., Cleveland
National Mach. Tool Co., Cincinnati

Screw Machines, Automatic
Brown & Sharpe Mfg. Co., Providence
Cleveland (O.) Auto Mach. Co.
Cone Auto. Mch. Co., Windsor, Vt.
National Acme Co., Cleveland
Screw Machines, Plain or Hand
Acme Mch. Tool Co., Cincinnati
Brown & Sharpe Mfg. Co., Providence
Dreses Mch. Tool Co., Cincinnati
Cleveland (O.) Auto Mach. Co.
Gisholt Machine Co., Madison, Wis.
Greenfield (Mass.) Tap & Die Corp.
Jones & Lamson Mch. Co., Springfield, Vt
Pratt & Whitney Co., Hartford, Conn.
Warner & Swasey Co., Cleveland

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Card Mfg. Co., S. W., Mansfield,
Carpenter Tap & Die Co., J. M., Pawtucket
Greenfield (Mass.) Tap & Die Corp.
Pratt & Whitney Co., Hartford, Conn.
Threadwell Tool Co., Greenfield,

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Allen Mfg. Co., Hartford
Bristol Co., Waterbury
Eastern Mch. Screw Corp., New Haven
National Acme Co., Cleveland
Strong, Carlisle & Hammond Co., Cleveland, O.

Screws, Machine
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Bristol Co., Waterbury
Davenport Mch. Tool Co., Rochester
Eastern Mach. Screw Corp., New Haven

Seamless Steel Tubing (See Tubing, Seamless Steel

Second-Hand Machinery (See Searchlight Section)

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Bennett Machinery Co., N. Y. C.
Botwinik Bros., Inc., New Haven
Brownell Mchy. Co., Providence
De Witt Tool Co., N. Y.
Eastern Machinery Co., Cincinnati
Eddy Machy. Co., E. A., Providence
Easley Mchy. Co., E. L., Chicago
Failor Co. Inc. N. C., N. Y.
General Machinery Co., Boston
Hill Clark & Co., Chicago
Hyman & Sons, Jos., Philadelphia
Miles Machinery Co., Saginaw
Morey & Co., N. Y.
Osborne & Sexton Mchy. Co., Columbus
Riverside Machinery Depot, Detroit
Scherr Co., Geo., N. Y.
Simmons Mach. Tool Corp., Albany
Wayne Mchy. Co., Ft. Wayne
Wickes Mchy. Co., Jersey City

Shafting
Hawkridge Bros., Boston
National Tube Co., Pittsburgh
Strand & Co., N. A., Chicago
Union Drawn Steel Co., Beaver Falls

Shafts, Flexible
Haskins Co., N. A., Chicago
Strand & Co., N. A., Chicago
White Dental Mfg. Co., S. S., N. Y.

Shapers
Hendey Machine Co., Torrington

Shapers, Machine
American Tool Wks. Co., Cincinnati
Automatic Mach. Co., Bridgeport
Hendey Mach. Co., Torrington, Conn.
Kelly Co., R. A., Xenia, Ohio
Niles Tool Works Co., N. Y.
Potter & Johnston Mch. Co., Pawtucket.
Reed-Prentice Corp., Worcester
Smith & Mills Co., Cincinnati
Springfield (O.) Mach. Tool Co.
Steel Products Eng. Co., Springfield, O.

Shapes, Cold Drawn Spinal Steel
Union Drawn Steel Co., Beaver Falls

Shear Blades
Simonds Saw & Steel Co., Fitchburg,

Shears, Hand
Armstrong-Blum Mfg. Co., Chicago
Tucker, W. A. & C. F., Hartford

Shears, Power
Adriance Mach. Wks., Brooklyn
Buffalo (N. Y.) Forge Co.
Landis Mch. Co., Waynesboro.
Mitts & Merrill, Saginaw
Murchey Mach. & Tool Co., Detroit
Niagara Mch. & T. Wks., Buffalo
Ryerson & Son, Jos. T., Chicago
Toledo (O.) Mch. & Tool Co.

Sheet Metal Working Machinery
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Bliss Co., E. W., Brooklyn
Cincinnati (O.) Gear Cutting Mach. Co.
Niagara Machine & Tool Wks., Buffalo, N. Y.
Ryerson & Son, Jos. T., Chicago
Toledo (O.) Mch. & Tool Co.

Sleeves, Taper
Schuchardt & Schutte (Geo. Scherr) N. Y.

Slotting Machines
Cons. Mach. Tool Corp., Rochester
Manning, Maxwell & Moore, N. Y.
Niles Tool Works Co., N. Y.
Sellers & Co., Wm., Philadelphia
Shaw Crane-Putnam Machine Co., Fitchburg

Speed Reducers
Boston Gear Wks., Norfolk Downs
Foote Bros. Gear & Mach. Co., Chicago
Grant Gear Wks., Inc., Boston
Jones Fdry. & Machine Co., W. A., Chicago
Philadelphia (Pa.) Gear Works
Shephard Electric Crane & Hoist Co., Montour Falls, N. Y.

Spindles
Ex-Cell-O Tool & Mfg. Co., Detroit

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Fostoria (O.) Screw Co.
Hjorth Lathe & Tool Co., Boston

Springs
Fischer Spring Co., Chas., Brooklyn

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Boston Gear Wks. Sales Co., Norfolk Downs
Cullman Wheel Co., Chicago.
Grant Gear Wks., Boston.
Jones Fdry. & Machine Co., W. A., Chicago
Link-Belt Co., Chicago
Philadelphia (Pa.) Gear Works
Whitney Mfg. Co., Hartford

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American Pulley Co., Philadelphia
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Detroit (Mich.) Stamping Co.

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Hoggson & Peters Mfg. Co., New Haven
Noble & Westbrook Mfg. Co., Hartford
Schmidt, Geo. T., Chicago
Schwerdtle Stamp Co., Bridgeport

Stands, Portable (See Furniture, Machine Shop)

Starters, Automatic
Cutler-Hammer Mfg. Co., Milwaukee

Steel Castings
West Steel Casting Co., Cleveland

Steel, Cold Rolled Strip
Carpenter Steel Co., Reading
Hawkridge Bros. Co., Boston
Union Drawn Steel Co., Beaver Falls

Steel Crucible
Carpenter Steel Co., Reading
Columbia Tool Steel Co., Chicago Heights
Simonds Saw & Steel Co., Fitchburg,

Steel, Rustless and Stainless
Carpenter Steel Co., Reading
Firth-Sterling Steel Co., McKeesport

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Jessop & Sons, Wm., N. Y.
Ryerson & Son, Jos. T., Chicago
Simonds Saw & Steel Co., Fitchburg,

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Central Alloy Steel Corp., Massillon
Cleveland (O.) Twist Drill Co.
Columbia Tool Steel Co., Chicago Heights
Firth-Sterling Steel Co., McKeesport
Hawkridge Bros., Boston
Jessop Steel Co., Washington, Pa.
Latrobe (Pa.) Electric Steel Co.
Ludlum Steel Co., Watervliet, N. Y.
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Simonds Saw & Steel Co., Fitchburg
Union Drawn Steel Co., Beaver Falls
Vanadium Corp. of America, N. Y.
Vulcan Crucible Steel Co., Aliquippa,

Steel, Cold Drawn, Special Shapes
Union Drawn Steel Co., Beaver Falls

Stools, Shop (See Furniture, Machine Shop)

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Springfield (O.) Mach. Tool Co.

Stud Setters, Self-Opening
Atwood Mfg. Co., Anderson, Ind.
Geometric Tool Co., New Haven

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Danly Machine Specialties, Chicago
U. S. Tool Co., Ampere, N. J.
Waltham (Mass.) Mach. Works

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Etna Machine Co., Toledo
Langelier Mfg. Co., Cranston, R. I.
Torrington Co., Torrington

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Cutler-Hammer Mfg. Co., Milwaukee

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Bristol Co., Waterbury
Zernickow Co., O., N. Y.

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Procunier, Wm. L., Chicago
Walton Co., Hartford

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Errington Mech. Laboratory, N. Y.
Greenfield (Mass.) Tap & Die Corp.
McCrosky Tool Corp., Meadville, Pa.

Taper Pins
Pratt & Whitney Co., Hartford, Conn.

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Lufkin Rule Co., Saginaw
Starrett Co., L. S., Athol, Mass.

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American Tool Wks. Co., Cincinnati
Ames Co., B. C., Waltham
Anderson Die Machine Co., Bridgeport
Baker Bros., Toledo
Barber-Colman Co., Rockford
Barnes Drill Co., Inc., Rockford
Boeger-Meyer Mach. & Tool Co., Newark
Cincinnati (O.) Bickford Tool Co
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Fox Mach. Co., Jackson, Mich.
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Langelier Mfg. Co., Cranston, R. I.
Moline (Ill.) Tool Co.
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National Mchy. Co., Tiffin.
Wahlstrom Tool Co., Brooklyn
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Carpenter Tap & Die Co., J. M., Pawtucket
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Murchey Mach. & Tool Co., Detroit
National Acme Co., Cleveland
National Tool Co., Cleveland
Pratt & Whitney Co., Hartford, Conn.
Threadwell Tool Co., Greenfield,

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Cons. Mach. Tool Corp., Rochester
Eastern Mch. Screw Corp., New Haven
Geometric Tool Co., New Haven
Landis Mach. Co., Waynesboro
Murchey Mach. & Tool Co., Detroit
National Acme Co., Cleveland
Standard Tool Co., Cleveland

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Hanson Whitney Mach. Co., Hartford
Jones & Lamson Mach. Co., Springfield, Vt.
Threadwell Tool Co., Greenfield

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General Electric Co., Schenectady

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Lowe, Henry E., Cleveland
Shore Instrument & Mfg. Co., Jamaica, N. Y.

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Bristol Co., Waterbury

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Pratt & Whitney Co., Hartford, Conn.
Rivett Lathe & Grinder Corp., Boston
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Thread Rolling Machines
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Eastern Mch. Screw Corp., New Haven
Geometric Tool Co., New Haven
Grant Mfg. & Mch. Co., Bridgeport
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Kent Machine Co., Cuyahoga Falls
Landis Mach. Co., Waynesoro
Murchey Mach. & Tool Co., Detroit
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Firth-Sterling Steel Co., McKeesport
Simonds Saw & Steel Co., Fitchburg,

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Waterston, J. M., Detroit

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Armstrong Bros. Tool Co., Chicago
O. K. Tool Co., Shelton

Tool Posts, Lathe
Armstrong Bros. Tool Co., Chicago
O. K. Tool Co., Shelton

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Tools, Small (See Machinists' Small Tools)

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Wagner Electric Corp., St. Louis
Westinghouse Elect. & Mfg. Co., East Pittsburgh

Transmission Machinery
Foote Bros. Gear & Machine Co., Chicago
Jones Fdry. & Machine Co., W. A., Chicago
Link-Belt Co., Chicago
Moore & White Co., Philadelphia
Whitney Mfg. Co., Hartford

Transportation System (See Trucks)

Trolleys & Tramways
Nuttall Co., R. D., Pittsburgh
Shepard Oil Crane & Hoist, Montour Falls

Trucks, Hand Power and Lift
Marion (Ind.) Tool Works
National Tube Co., Pittsburgh

Trucks, Hand, Pressed Steel
American Pulley Co., Phila.

Turret Machines (See Lathes, Horizontal Turret)

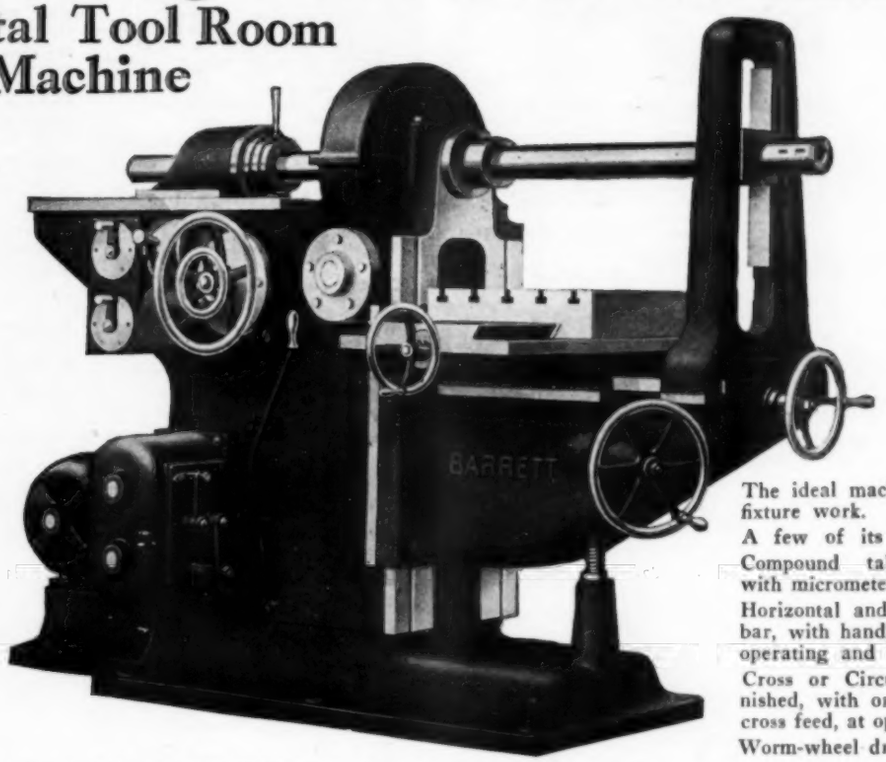
Turrets, Tool Post
American Tool Wks. Co., Cincinnati
McCrosky Tool Corp., Meadville, Pa.

Unions, Pipe
Dart Mfg. Co., U. M., Providence

Valves, Air Control
Logansport (Ind.) Mach. Co.

Announcing the NEW BARRETT

Horizontal Tool Room Boring Machine



Write for Bulletin No. 13 giving complete specifications.

BARRETT MACHINE TOOL CO., Inc. Meadville, Pa.

The ideal machine for jig and fixture work.

A few of its features are:—

Compound table adjustments with micrometer dials.

Horizontal and fixed height of bar, with handy location of all operating and control levers.

Cross or Circular Table furnished, with or without power cross feed, at option of customer.

Worm-wheel driven boring bar.

***A new time saver with* BARRETT *Dependability—Bore it with a* BARRETT**

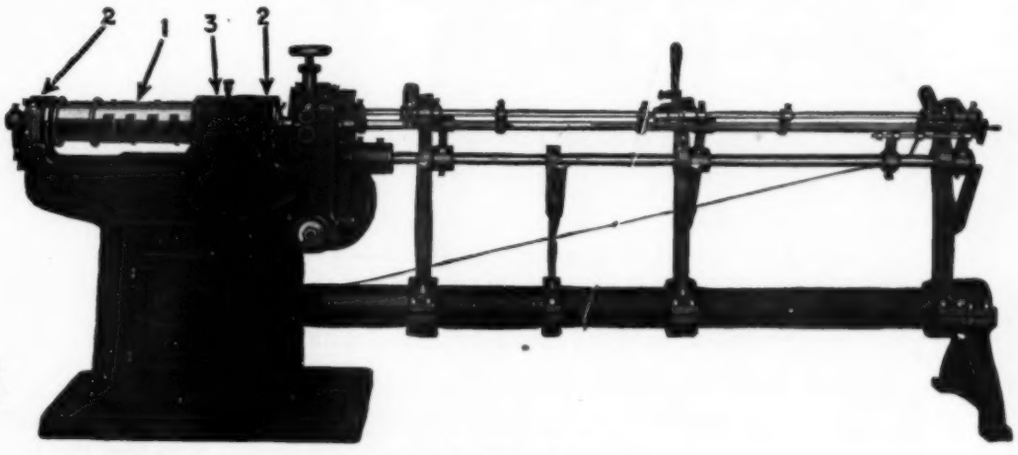
Steel Straightening Arbor

(marked 1)

mounted in Timken Roller Bearings

(marked 2)

are only two of the points making for great durability in the



Shuster One Belt Driven Automatic Wire Straightening and Cutting Machine

shown here

The place marked No. 3 indicates the position of the HARDENED TOOL STEEL WORM AND BRONZE WORM GEAR, which are mounted in a housing to permit of running them in oil, and this is another strong service feature. They drive the feed and cut off from the arbor.

If you prefer motor driven, self contained machines, they can be readily adapted for it at slight expense.

THE F. B. SHUSTER COMPANY, New Haven, Conn.

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Hoggson & Pettis Mfg. Co., New
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Vises, Metal Workers'
Fulton Drop Forge Co., Canal Fulton
Reed Mfg. Co., Erie.

Vises, Milling Machine
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Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Milling Mch. Co.
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Greenfield (Mass.) Tap & Die Corp.
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Logansport (Ind.) Mach. Co.
Reed-Prentice Corp., Worcester
Whitney Mfg Co., Hartford
Zernickow Co., O., N. Y.

Vises, Pipe
Greenfield (Mass.) Tap & Die Corp.
Reed Mfg. Co., Erie
Williams & Co., J. H., Buffalo

Vises, Planer and Shaper
Cincinnati (O.) Planer Co.
Hoggson & Pettis Mfg. Co., New Haven, Conn.

Vises, Universal Machine
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Positive Lock Washer Co., Newark,

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Welding Machine Spot
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Hawkridge Bros. Co., Boston
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Simplex Wire & Cable Co., Boston

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Shuster Co., F. B., New Haven

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Whitney Mfg. Co., Hartford

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Cook, Asa. S., Hartford

Wood Working Machinery
Blount Co., J. G., Everett
Seneca Falls (N. Y.) Machine Co.

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Williams & Co., J. H., Buffalo

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Greenfield (Mass.) Tap & Die Corp
Williams & Co., J. H., Buffalo

Wrenches, Ratchet
Starrett Co., L. S., Athol, Mass.

Wrenches, Tap
Greenfield (Mass.) Tap & Die Corp
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Threadwell Tool Co., Greenfield.

Don't Pay *for* Spoiled Parts

When you put the raw material in your planer, shaper or lathe, can you bank on a perfect finished product?

Seldom!

Flaws will turn up in the stock—

Slips will be made by the tools—

Mistakes will be made by the mechanic—

But you *pay* for them all.

The advertisers in the Contract Work Section of the American Machinist contract to furnish *perfect* parts. You buy the finished product—all waste is shouldered by the maker.

They are reputable—they are accurate—your job is their job.

Give them a trial.

Contract Work Section

WHEN

you watch one in operation

you'll think of sales

JUST watch this C-H Magnetic Clutch in operation! A touch of a finger to a switch and smoothly, easily, without a jerk or jar, the load is accelerated.

As a machinery builder, you will realize —here is a clutch that gives smooth pick-up automatically; it is simple—nothing to get out of order! What a sales feature for any machine!

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Why not arrange for C-H engineers to go over your products with you. See what they suggest in the way of using these clutches for improvement.

Just two members—no small levers, toggles or links to get out of order

This booklet tells the entire story. You owe it to your product to read it. Just ask for Publication No. P-32

The CUTLER-HAMMER Mfg. Co.
Pioneer Manufacturers of Electric Control Apparatus
1230 St. Paul Avenue
MILWAUKEE, WISCONSIN

CUTLER C-H HAMMER

Industrial Efficiency Depends on Electrical Control

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Federal Machine & Welder Co.	78
Federal Press Co.	90
Federal Products Corp.	94
Fellows Gear Shaper Co.	14-15
Firth-Sterling Steel Co.	76
Fischer Spring Co Chas.	105
Fitchburg Grinding Machine Co.	84
Flather Co.	88
Foote Bros. Gear & Mach. Co.	66
Foote-Burt Co.	86
Ford Chain Block Co.	79
Fosdick Mach. Tool Co.	40
Fostoria Screw Co.	99
Fox Machine Co.	86
Franklin Die Casting Corp.	63
Franklin Machine Co.	104
Fulton Drop Forge Co.	96
Gallmeyer & Livingston Co.	83
Gammons-Holman Co.	100
General Machinery Corp.	111
Geometric Tool Co.	99
Gilbert & Barker Mfg. Co.	78
Gisholt Machine Co.	38-39
Gits Bros. Mfg. Co.	62
Gleason Works	67
Goddard & Goddard Co.	98
Gorton Machine Co., Geo.	62
Goss & deLeeuw Mach. Co.	81
Graham Mfg. Co.	86, 96
Grant Gear Works	66
Grant Mfg. & Machine Co.	90
Gray Co., G. A.	40
Gray & Prior Machine Co.	97
Greaves-Klusman Tool Co.	46
Greenfield Tap & Die Corp.	29
H & O Mchy. & Eng. Co.	100
Hall Planetary Co.	82
Hanson-Whitney Machine Co.	37
Hardinge Bros.	88
Harrington Co.	79
Hartford Special Machinery Co.	65, 104
Hartford Steel Ball Co.	60
Haskins Co., R. G.	68
Hawkridge Bros. Co.	76
Heald Machine Co.	26
Hendey Mach. Co.	24
High Speed Hammer Co.	92
Hill Clarke & Co., of Chicago	107
Hisey Wolf Machine Co.	68
Hjorth Lathe & Tool Co.	87
Hoefer Mfg. Co.	87
Hoggson & Pettis Mfg. Co.	94
Hunter Saw & Machine Co.	98
Husky Wrench Co.	97
Hyman & Sons, Joseph	110
Ingersoll Milling Machine Co.	18
International Machine Tool Co.	88
Jessop & Sons, Wm.	72
Johnson Gas Appliance Co.	78
Johnson Machine Co., Carlyle	2
Jones Foundry & Machine Co., W. A.	60
Jones & Lamson Machine Co.	10-11
Kearney & Trecker Corp.	22
Kelly Co., R. A.	83
Keller Mechanical Eng. Corp.	104
Kent Machine Co.	86
Kingsbury Mfg. Co.	85
Knight Machinery Co., W. B.	82
Landis Machine Co.	51
Landis Tool Co.	45
Langelier Mfg. Co.	102
Lapointe Co., J. N.	89
Lapointe Machine Tool Co.	98
Latrobe Electric Steel Co.	76
Leland-Gifford Co.	85
Lincoln Electric Co.	121
Lincoln Machine Co.	104
Linde Air Products Co.	3rd cover
Link Belt Co.	2nd cover
Littell Machine Co., F. J.	102
Lodge & Shipley Mach. Tool Co.	4-5
Logansport Machine Co.	78
Lowe, Henry A.	94
Lucas Machine Tool Co.	42
Ludlum Steel Co.	72
McCrosky Tool Corp.	100
McGraw-Hill Book Co.	97, 101
Machine Products Co.	66
Magnolia Metal Co.	72
Manchester Tool Co.	99
Manning, Maxwell & Moore	47
Mead Cycle Co.	111
Mehl Machine Tool & Die Co.	104
Meisel Press Mfg. Co.	65
Merrell Mfg. Co.	92
Miles Machinery Co.	110
Milwaukee Die Casting Co.	63
Mitts & Merrill	80
Moline Tool Co.	86
Monarch Machine Tool Co.	36
Moore & White Co., Inc.	60
Morey & Co., Inc.	108
Morris Machine Tool Co.	85
Murchey Machine & Tool Co.	102
National Acme Co.	28
National Automatic Tool Co.	34
National Cash Register Co.	106
National Machinery Co.	92
National Mach. Tool Builders Assn.	2
National Tool Co.	98
National Tool Salvage Co.	105
National Twist Drill & Tool Co.	96
Newark Gear Cutting Machine Co.	68
New Britain Machine Co.	52
New Departure Mfg. Co.	19
Ney Co., J. M.	62
Niagara Machine & Tool Co.	92
Nicholson & Co., W. H.	100
Niles Tool Wks. Co.	32
Noble & Westbrook Mfg. Co.	94
Norton Co.	43
Nuttall Co., R. D.	66
Oakite Products, Inc.	Front Cover
Oesterlein Mach. Co.	82
Ohio Electric & Controller Co.	68
Oliver Instrument Co.	92
O. K. Tool Co.	98
Orteig Motor Co.	104
Osborne & Sexton Machy. Co.	110
Peerless Machine Co.	92
Pennsylvania Gear & Machine Co.	66
Philadelphia Gear Works	64
Phosphor Bronze Smelting Co.	72
Porter-McLeod Tool Works	87
Positions Vacant	106
Positions Wanted	106
Positive Lock Washer Co.	61
Potter & Johnston Machine Co.	20-21
Pratt & Whitney Co.	33
Precision Engineering Co.	104
Professional Services	106
Raybestos Co.	60
Reed Mfg. Co.	96
Reed-Prentice Corp.	50
Reliance Electric & Engr. Co.	63
Rhoads & Sons, J. E.	60
Riverside Machinery Depot	111
Rivett Lathe & Grinder Corp.	62
Rockford Drilling Machine Co.	86
Rowbottom Machine Co.	82
Royal Typewriter Co.	106
Ryerson, Joseph T. & Son	88
Saunders Sons, D.	100
Scherr Co., Geo.	00, 82, 83, 92, 94, 96, 113
Schmidt, Geo. T.	100
Schwerdtle Stamp Co.	76
Scofield Co.	104
Sellers & Co., Wm.	48-49
Seneca Falls Machine Co.	88
Sentry Co.	78
Shaw Crane-Putnam Mach. Co.	47
Shepard Elect. Crane & Hoist Co.	80
Shore Instrument & Mfg. Co.	96
Shuster Co., F. B.	123
Simonds Mfg. Co.	66
Simonds Saw & Steel Co.	115
Simmons Machine Tool Corp.	109
Simplex Tool Co.	96
Simplex Wire & Cable Co.	103
Skinner Chuck Co.	96
Slocomb & Co., J. T.	95
Smith Mchy. Co., H. A.	111
Smith & Mills Co.	83
South Bend Lathe Works	88
Spraco Painting Equip. Co.	103
Springfield Machine Tool Co.	88
Standard Conveyor Co.	117
Standard Electric Tool Co.	83
Stark Tool Co.	89
Starrett Co., L. S.	57
Steinle Turret Machine Co.	89
Stewart Die Casting Corp.	63
Strand & Co., N. A.	68
Strong, Carlisle & Hammond Co.	61, 78
Sundstrand Machine Tool Co.	103
Swift Electric Welder Co.	78
Taft-Pierce Mfg. Co.	89
Taylor & Fenn Co.	82
Thompson & Son Co., H. G.	72
Thomson Electric Welding Co.	78
Threadwell Tool Co.	99
Toledo Machine & Tool Co.	91
Torrington Co.	59
Tucker, W. A. & C. F.	62
Underwood Corp., H. B.	103
Union Drawn Steel Co.	76
Union Electric Mfg. Co.	68
Union Mfg. Co.	94
Union Twist Drill Co.	25
United States Machine Tool Co.	83
Universal Boring Mach. Co.	87
U. S. Drill Head Co.	87
U. S. Tool Co.	91
V. & O Press Co.	92
Vanadium Alloys Steel Co.	72
Vanadium Corp. of America	73
Van Norman Machine Tool Co.	80
Veeder Mfg. Co.	95
Vulcan Crucible Steel Co.	76
Wagner Elect. Corp.	69-70
Wahlstrom Tool Co.	94
Walker Co., O. S.	83
Waltham Machine Works	82
Walton Co.	103
Warner & Swasey Co.	30-31
Waterston, J. M.	100
Watson Stillman Co.	96
Wayne Machinery Co.	110
Weldit Acetylene Co.	78
Westcott Chuck Co.	94
Westinghouse Elect. & Mfg. Co.	71
West Steel Casting Co.	98
White Dental Mfg. Co., S. S.	68
Whitney Mfg. Co.	53
Whiton Machine Co., D. E.	94
Wickes Bros.	103
Wickes Machinery Co.	113
Wisconsin Electric Co.	68
Zernickow, Co. O.	66